JPRS 83419

6 May 1983

USSR Report

ELECTRONICS AND ELECTRICAL ENGINEERING

No. 103

NOTE

JPRS publications contain information primarily from foreign newspapers, periodicals and books, but also from news agency transmissions and broadcasts. Materials from foreign-language sources are translated; those from English-language sources are transcribed or reprinted, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by JPRS. Processing indicators such as [Text] or [Excerpt] in the first line of each item, or following the last line of a brief, indicate how the original information was processed. Where no processing indicator is given, the information was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear in the original but have been supplied as appropriate in context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by source.

The contents of this publication in no way represent the policies, views or attitudes of the U.S. Government.

PROCUREMENT OF PUBLICATIONS

JPRS publications may be ordered from the National Technical Information Service (NTIS), Springfield, Virginia 22161. In ordering, it is recommended that the JPRS number, title, date and author, if applicable, of publication be cited.

Current JPRS publications are announced in Government Reports Announcements issued semimonthly by the NTIS, and are listed in the Monthly Catalog of U.S. Government Publications issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Correspondence pertaining to matters other than procurement may be addressed to Joint Publications Research Service, 1000 North Glebe Road, Arlington, Virginia 22201.

JPRS REPORTS

Japan Report
Korean Affairs Report
Southeast Asia Report
Mongolia Report

Near East/South Asia Report
Sub-Saharan Africa Report
West Europe Report
West Europe Report: Science and Technology
Latin America Report

USSR

Political and Sociological Affairs
Problems of the Far East
Science and Technology Policy
Sociological Studies
Translations from KOMMUNIST
USA: Economics, Politics, Ideology
World Economy and International Relations
Agriculture
Construction and Related Industries
Consumer Goods and Domestic Trade
Economic Affairs
Energy
Human Resources
International Economic Relations
Transportation

Physics and Mathmetics
Space
Space Biology and Aerospace Medicine
Military Affairs
Chemistry
Cybernetics, Computers and Automation Technology
Earth Sciences
Electronics and Electrical Engineering
Engineering and Equipment
Machine Tools and Metal-Working Equipment
Life Sciences: Biomedical and Behavioral Sciences
Life Sciences: Effects of Nonionizing Electromagnetic Radiation
Materials Science and Metallurgy

EASTERN EUROPE

Political, Sociological and Military Affairs
Scientific Affairs

Economic and Industrial Affairs

CHINA

Political, Sociological and Military Affairs
Economic Affairs
Science and Technology

RED FLAG
Agriculture
Plant and Installation Data

WORLDWIDE

Telecommunications Policy, Research and Development
Nuclear Development and Proliferation

Environmental Quality
Epidemiology

FBIS DAILY REPORT

China
Soviet Union
South Asia
Asia and Pacific

Eastern Europe
Western Europe
Latin America
Middle East and Africa

To order, see inside front cover

JPRS 83419

6 May 1983

USSR REPORT

ELECTRONICS AND ELECTRICAL ENGINEERING

No. 103

CONTENTS

AEROSPACE & ELECTRONICS SYSTEMS

Effectiveness of Some Methods of Determining Positions of Planets by Optoelectronic Measurement Systems
(Yu. A. Seliverstov, B. N. Avsenin; OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST', Dec 82)..... 1

Using Loran-C Navigation System Signals To Compare Time Scales
(L. A. Dzhizhevskaya, et al.; IZMERITEL'NAYA TEKHNIKA, Jul 81)..... 1

Reducing Scale Comparison Errors in Standard Time Stores by Meteor Path Radio Wave Propagation
(V. P. Moiseyev, et al.; IZMERITEL'NAYA TEKHNIKA, Jul 81).... 2

Calculating Compensator for Interference Checking Astronomical Mirrors
(D. T. Puryayev, N. S. Shandin; OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST', Dec 82)..... 3

Spin Echo as Space Correlation Effect
(Yu. Ya. Yurov; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA, Jan 83)..... 3

Accuracy of Orientation of Solar Power Plants on Spacecraft
(N. A. Armand, et al.; RADIOTEKHNIKA I ELEKTRONIKA, Jan 83).. 4

ANTENNAS & PROPAGATION

Mutually Nonambiguous Correspondence Between Ideally Conducting Body and Field Scattered by It
(N. G. Ponomarev; RADIOTEKHNIKA I ELEKTRONIKA, Jan 83)..... 6

Electromagnetic Wave Diffraction by Two-Dimensionally Periodic Waveguide-Dielectric Array
(V. M. Krekhtunov, V. A. Tyulin; RADIOTEKHNIKA I ELEKTRONIKA, Feb 83)..... 6

Structure Characteristic of Refractive Index Fluctuations on Inclined Tropospheric Path
(T. I. Arsen'yan, et al.; RADIOTEKHNIKA I ELEKTRONIKA, Feb 83)..... 7

Experimental Study of Dielectric Stripline Waveguide Junctions in Millimeter Wave Band
(L. N. Vershinina; RADIOTEKHNIKA I ELEKTRONIKA, Feb 83).... 8

Reducing Number of Adaptation Channels in Antenna Arrays
(V. I. Samoylenko, et al.; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA, Jan 83)..... 8

Analysis of Emission Characteristics of Aperture Antenna Excited by Periodic Pulse Signal
(G. A. Polukhin; RADIOTEKHNIKA I ELEKTRONIKA, Feb 83)..... 9

Radiation From Horn Antennas
(V. A. Kaloshin, A. G. Eydus; RADIOTEKHNIKA I ELEKTRONIKA, Jan 83)..... 9

Choosing Optimum Rectenna Dipole Density
(G. P. Boyakhchyan, et al.; RADIOTEKHNIKA I ELEKTRONIKA, Feb 83)..... 10

Application of Mathematical Programming to Problems of Diffraction Synthesis of Antennas
(V. V. Martsafey; RADIOTEKHNIKA I ELEKTRONIKA, Feb 83)..... 11

Fluctuations in Angles of Emergence of Radio Waves With Scattering in Spherically Laminar Ionosphere
(B. V. Yukhmatov; RADIOTEKHNIKA I ELEKTRONIKA, Feb 83)..... 11

Influence of Refraction on Capture of Radio Waves in Ionospheric Waveguide
(V. D. Gusev, B. V. Yukhmatov; RADIOTEKHNIKA I ELEKTRONIKA, Feb 83)..... 12

BROADCASTING/CONSUMER ELECTRONICS

Low-Frequency Error of Multichannel Time-To-Pulse Converters in Digital Phase Meters
(A. P. Pokhilyuk; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE, Jan 83)..... 13

Professional Headphones
(L. I. Amlinskaya, et al.; TEKHNIKA KINO I TELEVIDENIYA, Jan 83)..... 14

Improving Efficiency of TV Channels
(R. M. Atakhanov, E. B. Makhmudov; TEKHNIKA KINO I TELEVIDENIYA, Jan 83)..... 14

Optical Facility for Modeling Closed Autotracking System
(V. G. Soshnikov, I. V. Fridlyand; TEKHNIKA KINO I TELEVIDENIYA, Jan 83)..... 15

Investigation of Metal Halide Lamps With Short Arc
(V. Dybchinski; TEKHNIKA KINO I TELEVIDENIYA, Jan 83)..... 15

Resolution of Motion Picture Lens-Camera-Film System
(A. I. Miroshnikov; TEKHNIKA KINO I TELEVIDENIYA, Jan 83).. 16

Recording TV Images on Motion Picture Film With Partial Image Storage
(V. M. Semenov; TEKHNIKA KINO I TELEVIDENIYA, Jan 83)..... 16

CIRCUITS & SYSTEMS

Tunable Ferrite Filters Using Waveguide-Dielectric Resonators
(V. A. Korobkin, et al.; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA, Jan 83)..... 18

Effect of Finite Bit Capacity on Efficiency of Digital Filters for Extraction of Signals Submerged in Background Interference
(A. N. Meleshkevich, V. N. Mikhaylyukov; RADIOTEKHNIKA I ELEKTRONIKA, Jan 83)..... 18

Wideband Power Dividers-Adders on Nonhomogeneous Transmission Lines
(A. P. Gorbachev, et al.; RADIOTEKHNIKA I ELEKTRONIKA, Jan 83)..... 19

COMMUNICATIONS

Correlation Function and Spectral Density of Continuous-Phase Frequency-Shift-Keyed Discrete Radio Signals
(V. N. Kharisov, Nguyen Dang Minh; RADIOTEKHNIKA I ELEKTRONIKA, Jan 83)..... 20

Synthesis of Optimum Signals for Single-Channel Delay Search Systems
(L. N. Barannikov, et al.; RADIOTEKHNIKA I ELEKTRONIKA, Jan 83)..... 20

Properties of Arrays of Frequency-Time Signals
(I. M. Pyshkin, R. T. Pantikyan; RADIOTEKHNIKA I ELEKTRONIKA, Jan 83)..... 21

Using Phase Keying in Optical Incoherent Correlator of Linear Frequency-Modulated Signals
(A. V. Shisharin, et al.; RADIOTEKHNIKA I ELEKTRONIKA, Feb 83)..... 22

Synchronizing Phase-Keyed Signals
(A. I. Velichkin, et al.; RADIOTEKHNIKA I ELEKTRONIKA, Feb 83)..... 22

Stability Study of Inertial Two-Loop Pseudorandom Signal Synchronization System
(V. P. Ponomarenko, G. F. Panysheva; RADIOTEKHNIKA I ELEKTRONIKA, Feb 83)..... 23

Synthesis of Systems for Data Processing and Analysis by Methods of Structural-Parametric Estimation
(Yu. P. Ryshkov, V. I. Suchkov; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE, Jan 83)..... 23

COMPONENTS, HYBRIDS & MANUFACTURING TECHNOLOGY

Generalized Method of Calculating Characteristics of Profiled Ferromagnetic Cores Made of Material With Square-Loop Hysteresis
(A. L. Shpadi, S. L. Shpadi; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE, Jan 83)..... 25

COMPUTERS

Analysis and Synthesis of Refractive-Diffractive Optical System
(V. G. Shitov; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA, Jan 83)..... 26

Statistical Characteristics of Fault Distribution in Semiconductor Memories
(P. P. Urbanovich, et al.; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE, Jan 83)..... 26

Application of Microprocessors to Digital Measurement Instruments
(P. P. Ornatskiy, V. G. Tsyvinskiy; IZMERITEL'NAYA TEKHNIKA, Jul 81)..... 27

Synthesis of Parallel High-Speed Generators of Pseudorandom Numbers
(V. N. Yarmolik; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE, Jan 83)..... 28

Development and Production of Radioelectronic Measuring Devices
(Boleslav Ziman; EKONOMICHESKOYE SOTRUDNICHESTVO STRAN-CHLENOV SEV, Oct 82)..... 28

Microcomputer Programming for Radio Amateurs
(G. Zelenko, et al.; RADIO, Nov 82)..... 29

CONTROL SYSTEMS

Stability of Pulse-Phase Automatic Control System With Trigger-Type Phase Detector and Integrator
(A. P. Kuznetsov; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE, Jan 83)..... 30

ELECTRICAL INSULATION

Dielectric Properties of Liquids at Submillimeter Wavelengths (Review)
(V. N. Apletalin, et al.; RADIOTEKHNIKA I ELEKTRONIKA, Jan 83)..... 31

ELECTRON DEVICES

Device for Dynamic Variation of Mirror Focal Length
(S. P. Khodtsev; OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST', Nov 82)..... 32

Optimization of Optical Receiver for Direct Detection of High-Frequency and Microwave Analog Signals
(N. Z. Shvarts, G. M. Brovko; RADIOTEKHNIKA I ELEKTRONIKA, Jan 83)..... 32

Electrostatic Deflecting Components That Do Not Produce Aberration Fourfolds
(A. L. Dodin; RADIOTEKHNIKA I ELEKTRONIKA, Feb 83)..... 33

Traveling-Wave Parametric Amplifier With Lower Pumping Frequency
(V. F. Marchenko, et al.; RADIOTEKHNIKA I ELEKTRONIKA, Jan 83)..... 34

Some Anomalies in Noise Characteristics of Gunn-Effect Diodes
(E. D. Prokhorov, S. N. Skorobogatova; RADIOTEKHNIKA I ELEKTRONIKA, Jan 83)..... 34

Phenomenological Analysis of Injection-Type Amplification
(B. M. Garin; RADIOTEKHNIKA I ELEKTRONIKA, Jan 83)..... 35

Effect of Higher-Order Oscillation Modes on Characteristics of Waveguide-Type p-i-n-Diode Control Devices
(V. G. Vinenko, et al.; RADIOTEKHNIKA I ELEKTRONIKA, Jan 83)..... 36

Investigation of Ring-Bar Slow-Wave System
(L. N. Loshakov, et al.; RADIOTEKHNIKA I ELEKTRONIKA, Feb 83)..... 36

Determining Inhomogeneities of Semiconductor Materials in Infrared Spectral Region
(A. K. Beketova, et al.; OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST', Dec 82)..... 37

INSTRUMENTATION & MEASUREMENTS

Metrological Support for Instruments To Measure Deviations From Linearity and Flatness
(L. L. Medyantseva, et al.; IZMERITEL'NAYA TEKHNIKA, Jul 81)..... 38

Limitation of Interference Noises in Optical Measurement Systems
(M. A. Bukhshtab; OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST', Nov 82)..... 39

Measuring Temperature Stability of Piezoelectric Hydrophone Sensitivity
(G. I. Belashchenko, et al.; IZMERITEL'NAYA TEKHNIKA, Jul 81)..... 39

Testing Relief and Leveling Surfaces Having Large Area
(V. V. Kozlov, et al.; IZMERITEL'NAYA TEKHNIKA, Jul 81).... 40

Measuring Displacements of Object With Respect to Six Coordinates by Laser Differential Method
(A. P. Bykov, et al.; OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST', Dec 82)..... 40

Feasibility of Mutual Compensation of Noise and Contrast-Frequency Characteristics of Image Converter
(Yu. G. Edel'shteyn, et al.; OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST', Dec 82)..... 41

Thermal Emitters for Determining Thermograph Parameters
(O. K. Shabashev, A. A. Muraveyskaya; OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST', Dec 82)..... 42

Measuring Ratio of Concentrations of Elements in Sea Water by Flame Photometer
(V. V. Vasilenko, et al.; OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST', Dec 82)..... 42

Effect of Mechanical Vibrations of Velometer on Accuracy of Motion Measurement in Fresnel Zone
(V. I. Shelukhin, Yu. P. Kernov; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA, Jan 83)..... 43

Error of Radio Altimeters in Measurement of Vertical Surface Profile
(V. I. Chizhov; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA, Jan 83)..... 44

Digital Swept-Tuned Spectrum Analyzer
(V. I. Chaykovskiy, V. Ya. Krakovskiy; IZMERITEL'NAYA TEKHNIKA, Jul 81)..... 44

High-Reflectivity Metal-Dielectric Mirrors Based on Copper
(N. N. Bulatov, et al.; OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST', Dec 82)..... 45

MAGNETICS

Standard Magnetic Permeability Sample for Measurements of Ferromagnet Characteristics at High and Microwave Frequencies
(N. N. Chernousova; IZMERITEL'NAYA TEKHNIKA, Jul 81)..... 46

Dispersion Characteristics of Magnetostatic Waves in Compound Ferrite-Dielectric-Metal Structures
(G. M. Novikov, et al.; RADIOTEKHNIKA I ELEKTRONIKA, Jan 83)..... 46

Volume and Surface Magnetostatic Waves in Metallized Structure With Two Ferrite Films
(A. S. Beregov; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA, Jan 83)..... 47

MICROWAVE THEORY & TECHNIQUES

Design of Half-Wavelength Resonator With Varactor Tuning
(S. M. Ryzhakov, L. Yu. Rotkov; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA, Jan 83)..... 48

Analysis and Synthesis of Semiconductor Half-Wavelength Ring Bridge
(V. I. Gvozdev, et al.; IZVESTIYA UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA, Jan 83)..... 49

Planar Transmission Lines Using Multilayer Dielectric
(M. N. Malyshev, I. G. Mironenko; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA, Jan 83)..... 49

Investigation of 3-dB Interdigital Microstrip Couplers With Additional Dielectric Layer
(V. B. Kartazhov, V. V. Lupulyak; RADIOTEKHNIKA I ELEKTRONIKA, Feb 83)..... 50

Selection of Varactor for Design of Tunable Microwave Oscillator
(Ye. A. Machusskiy; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA, Jan 83)..... 51

Matching Transformers for Waveguides Partly Filled With Ferroelectric Material
(M.V. Kononov, et al.; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA, Jan 83)..... 51

Broadband Discrete Microwave Phase Modulator
(V. A. Kalinin, et al.; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA, Jan 83)..... 52

Signal Characteristics of Autodyne Gunn-Diode Photoconductive Receiver With Self-Detection
(M. M. Doktorevich, V. G. Shinkarenko; RADIOTEKHNIKA I ELEKTRONIKA, Feb 83)..... 53

Feasibility of Microwave Oscillation Accompanying Avalanche Processes in Dipole Domains
(S. A. Kostylev, et al.; RADIOTEKHNIKA I ELEKTRONIKA, Feb 83)..... 53

Frequency Conversion of Radiation Modulation in Avalanche Photodiodes With Microwave Biasing
(V. V. Yakovlev; OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST', Nov 82)..... 54

POWER ENGINEERING

Damages From Power Failure at a Plastics Plant
(I. V. Kovanova, B. V. Papkov; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA, Sep 82)..... 55

Regressive Analysis of Damage From Power Failure at Oil Processing Plants
(Ye. M. Chervonnyy, T. M. Shchegol'kova; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA, Sep 82).... 60

Transient Processes in Cylindrical Electromagnetic Shields
(Andrey Vladimirovich Shchukin; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA, Nov 82)..... 67

QUANTUM ELECTRONICS/ELECTRO-OPTICS

Interference Filters for Protection From Parasitic Scattered Laser Radiation
(G. M. Malyshev, et al.; OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST', Nov 82)..... 68

Investigation of Spectral Method of Eliminating Block Structure in Image Transmitted by Fiber Optics
(P. A. Mikheyev, A. E. Puysha; OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST', Dec 82)..... 68

Thermal Deformation of Laser Active Element With Free Heat Exchange in Cavity of Two-Lamp Illuminator System
(I. F. Balashov, et al.; OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST', Nov 82)..... 69

Investigation of Thermo-Optic Properties of Multimode Light Guides
(B. G. Klevitskiy, I. P. Korshunov; RADIOTEKHNIKA I ELEKTRONIKA, Feb 83)..... 70

Fiber Gyrometer in Gravitational Field
(V. F. Fateyev; RADIOTEKHNIKA I ELEKTRONIKA, Jan 83)..... 70

SOLID STATE CIRCUITS

Interaction of Gallium With Intrinsic Defects in Germanium under Gamma Irradiation
(Ye. D. Vasil'yeva, et al.; FIZIKA I TEKHNIKA POLUPROVODNIKOV,Jan 83)..... 72

Effect of Irradiation Conditions on Interaction of Gold Dopant With Intrinsic Defects in Germanium
(Ye. D. Vasil'yeva, et al.; FIZIKA I TEKHNIKA POLUPROVODNIKOV, Jan 83)..... 73

Influence of Electric Field on Cyclotron Resonance Line Shape in n-GaAs
(O. Z. Alekperov, et al.; FIZIKA I TEKHNIKA POLUPROVODNIKOV, Jan 83)..... 73

Change in Recombination Properties of Deep Luminescence Centers With Annealing of Irradiated GaAs Crystals
(K. D. Glinchuk, et al.; FIZIKA I TEKHNIKA POLUPROVODNIKOV, Jan 83)..... 74

Parallel Optical Processor for Geometrical Transformation of Images
(L. B. Ochina; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE, Jan 83)..... 75

Mechanisms of Resonant Galvanomagnetic Effect in Ferrite-Semiconductor Structure
(T. D. Aliyev, et al.; IZVESTIYA AKADEMII NAUK TURKMENSKOY SSR: SERIYA FIZIKO-TEKHNICHESKIKH, KHIMICHESKIKH I GEOLOGICHESKIKH NAUK, Apr 82)..... 75

SONICS & ULTRASONICS

Barkhausen Noise Depression in Ferrites Under Ultrasonic Action
(G. S. Mikolaytis, V. P. Palenskis; RADIOTEKHNIKA I ELEKTRONIKA, Feb 83)..... 77

NEW ACTIVITIES: MISCELLANEOUS

Some Problems of Using Superconducting Exciter Windings in 'Frozen' Flux Mode
(Sergey Nikolayevich Ivanov, Ivan Dmitriyevich Lupkin; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA, Nov 82)..... 78

Energy Parameters of Superconducting Transformer Type Converters
(Vladimir Yevgen'yevich Ignatov, et al.; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA, Nov 82)..... 79

Study of a Nitrogen Cooled Cryoturbine Generator Model
(Vladimir Ivanovich Volovik, et al.; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA, Nov 82)..... 79

Capacitive Electric Motor for Rotation of Magnetically Suspended Superconducting Body
(Vasiliy Vasil'yevich Svyatyy; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA, Nov 82)..... 80

Selection of Protective Circuits for Electric Machines With Superconducting Magnetic Systems
(Dorvara Gurgenovich Akopyan; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA, Nov 82)..... 80

Control of Superconducting Exciter Winding Current
(Dmitriy Matveyevich Lerner; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA, Nov 82)..... 81

Response of Selective Receiver With Josephson Detector to Microwave Signals With Various Spectra
(V. A. Kulikov, M. N. Pospelov; RADIOTEKHNIKA I ELEKTRONIKA, Feb 83)..... 81

Field-Emission Capability of Cathode Filament Grown by Electric Discharge in $W(CO)_6$ Vapor
(N. P. Ovsyannikov, G. N. Shuppe; RADIOTEKHNIKA I ELEKTRONIKA, Jan 83)..... 82

Possibility of Designing High Speed Superconducting AC Machines
(Galina Spiridonovna Mavromati, et al.; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA, Nov 82).... 83

Stabilization of Superconducting State of Cable System by Automatic Regulation Equipment
(Igor' Vladimirovich Yakimets, et al.; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA, Nov 82)..... 83

Electrodynamic Transient Processes in Superconducting Magnetic Systems Upon Field Damping
(Leonid Isaakovich Yantovskiy, et al.; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA, Nov 82).... 84

Analysis of Influence of DC Cryomotor Load on Magnetomotive Force of Superconducting Exciter Winding With Power Supply Disconnected
(Vladimir Ivanovich Milykh; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA, Nov 82)..... 85

Equations of Synchronous Machine With Superconducting Exciter Winding and Distributed Parameters
(Israfil Teymurovich Talyshinskiy; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA, Nov 82)..... 85

Methods of Calculating Electromagnetic Fields of Superconducting Unipolar Electric Machines
(Yelena Borisovna Belopol'skaya, et al.; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA, Nov 82)... 86

Study of Thermal Field of Turbogenerator Rotor With Superconducting Exciter Winding
(Sergey Nikolayevich Belyayev, et al.; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA, Nov 82)..... 87

Calculation of Electrodynamic Forces Acting on Cylindrical Cryoturbine Generator Rotor Envelopes During Transient Processes
(Valeriy Petrovich Kuyevda; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA, Nov 82)..... 88

Calculation of Currents in Cryoturbine Generator Windings Upon Sudden Three Phase Short Circuit on Stator Terminals
(Vladimir Yevgen'yevich Sigayev; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA, Nov 82)..... 88

Specifics of Startup of Automatic AC Electric Drive With Superconducting Synchronous Machines
(Valeriy Yulnanovich Voskobovich, et al.; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA, Nov 82)... 89

UDC 521.23:621.397

EFFECTIVENESS OF SOME METHODS OF DETERMINING POSITIONS OF PLANETS BY OPTOELECTRONIC MEASUREMENT SYSTEMS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 12, Dec 82 (manuscript received 18 Oct 81) pp 20-22

SELIVERSTOV, Yu. A. and AVSENIN, B. N.

[Abstract] A simulator for the process of determining the positions of minor planets is described and used to obtain relations for the selected criterion of effectiveness of orthogonal and affine processes of astronomical reduction as a function of the field of view of the measurement system for different values of instrumental error. The results show the limits of applicability of the orthogonal and affine methods. The orthogonal method of astronomical reduction is found to be optimum for automated optoelectronic measurement systems for determining the positions of planets when extended to two or more reference stars. In cases where analytical description of a situation is not possible, simulator modeling of the behavior of the measurement system not only enables selection of optimum algorithms for processing measurement information, but also optimization of existing parameters of the system. Figures 2; references: 6 Russian.
[177-6610]

UDC 529.781:389.14

USING LORAN-C NAVIGATION SYSTEM SIGNALS TO COMPARE TIME SCALES

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 7, Jul 81 pp 38-39

DZHIZHEVSKAYA, L. A., IVAKIN, V. M. and TIL'K, E. M.

[Abstract] Loran-C signals propagated via the ionosphere can be used for standard time scale comparison at points thousands of km apart, where the error amounts to only a few microseconds. The SL-1(M) and SL-1(X) Loran-C station signals were received daily under conditions of equal illumination of the ionospheric propagation paths. The distances to the stations were calculated as 1,532 and 1,669 km, respectively, where the paths passed over the Balkan peninsula and the open sea. The difference between the standard time

scales of the Soviet Union and the International Time Bureau were determined from these data. The seasonal changes in the propagation time from the SL-1(M) and SL-1(X) stations are the same. The mean square random errors in the comparison of the UTC and UTC(SU) standard time scales are summarized in tabular form for the 12 months of the year during 1977, 1978 and 1979; these errors do not exceed ±1.0 microseconds. The data show that standard time scales can be synchronized with an error of less than 6 microseconds using the ionospheric component of Loran-C signals. With further corrections obtained by averaging over several years for each month, this error will be even less. Figures 1; tables 2; references: 4 Western.
[35-8225]

UDC 529.781:621.371

REDUCING SCALE COMPARISON ERRORS IN STANDARD TIME STORES BY METEOR PATH RADIO WAVE PROPAGATION

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 7, Jul 81 pp 41-44

MOISEYEV, V. P., DUDNIK, B. S., KASHCHEYEV, B. L., KOVAL', Yu. A. and PUSHKIN, S. B.

[Abstract] The use of radio wave reflections from ionized meteor trails to compare standard time scales at distances of up to 2,000 km is promising because of the considerably lower cost, as compared to satellite systems and even other types of ground communications. Because the sporadic availability of meteor trails produces errors caused by the association noise in a communications channel, it is worthwhile to study ways of optimizing system performance which do not necessarily involve the cost of boosting transmitter power or employing wideband signals. This paper analyzes the effect of signals with various waveforms, using the criterion of a minimum error in the time position, in order to determine the optimal transmitter power and signal bandwidth for two cases: a constant signal energy and a constant pulse power. It is assumed that the signals are received against a background of additive fluctuating interference with a limited channel bandwidth. Analytical expressions are derived for the potentially attainable error in the estimate of the time position of the signals for the two cases above. The waveforms considered are: rectangular, triangular, trapezoidal, bell-curve, cosine and sinC. The most efficient is the latter in terms of energy utilization, while the bell curve is the least efficient. The advantage gained through the use of complex waveforms in place of simple ones and the advantages of two-way radio communications to compensate for equipment delays are evaluated quantitatively. A block diagram of a proposed equipment configuration is presented along with timewise diagrams of the pulse flows which illustrate the impact of changes in the hardware delays on the error in the measurement of time scale shift. This technique of delay compensation is not only applicable to meteoric scatter, but also to passive earth satellite systems. When active reflectors or repeaters are employed, it is essential

to preclude the possibility of several signals appearing simultaneously at the repeater input, or to provide the capability of discriminating these signals. Figures 2; tables 1; references 7: 6 Russian, 1 Western.
[35-8225]

UDC 621.317.727.2:[681.7.062:520.2]

CALCULATING COMPENSATOR FOR INTERFERENCE CHECKING ASTRONOMICAL MIRRORS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 12, Dec 82 (manuscript received 12 Nov 81) pp 23-24

PURYAYEV, D. T. and SHANDIN, N. S.

[Abstract] Twyman-Green interferometers are used for checking the figure on large astronomical telescope mirrors. When used for this purpose, the working arm of the interferometer contains a compensator that converts a spherical or planar wave front to an aspherical front that coincides with the theoretical shape of the mirror being checked. The authors describe a technique for calculating a compensator with zero aperture that converts a planar wave front to aspherical. Such a compensator consists of two lenses: telescopic and positive meniscus with parallel paraxial rays between them. By varying the air gap between lenses, spherical aberration of higher orders can be corrected without changing the spherical aberration of third order. Initial data for calculating the compensator with zero aperture are the thicknesses and indices of refraction of the lenses, paraxial magnification of the telescopic lens, the back focus of the compensator and its first Seidel sum. The analysis is based on conventional formulas of the theory of third-order aberrations. Characteristics are determined for compensators to be used in interference checking the figure of parabolic mirrors with diameter of 2.6 and 6 m. Figures 2; tables 1; references: 3 Russian.
[177-6610]

UDC 621.396.67

SPIN ECHO AS SPACE CORRELATION EFFECT

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 26, No 1, Jan 83 (manuscript received after completion 14 Jun 82) pp 74-80

YUROV, Yu. Ya.

[Abstract] Spin echo is used in correlational radar for finding the cross-correlation between transmitted and received signals. Here the spin system constitutes an optimum filter which tunes itself to the waveform of the transmitted signal so as to make possible operation with nonrecurrent signals.

Its performance is limited not only by its bandwidth but also by the relaxation times, transverse and longitudinal, of the medium. The role of both relaxation times in determining the shape of the echo pulse is established here on the basis of the Bloch equation of change of angular momentum for the magnetic moment. Through multiplication of the skew-symmetric moment tensor by the magnetization vector and magnetic field intensity vector, with basis vectors along the principal axes of the tensor, this equation is reduced to three scalar ones. Integration twice of the latter with respect to time yields a Volterra integral equation equivalent to the Bloch equation. The spin system performs a Fourier transformation in space filled with precessing magnetic dipoles, their precession being determined by earlier signals, and different dipoles precessing at different frequencies because of nonuniformity of the constant magnetic field. The spin system also performs an inverse Fourier transformation, which yields the cross-correlation function for transmitted and received signals. References 3: 1 Russian, 2 Western (1 in translation).
[150-2415]

UDC 629.78:621.396.67.01

ACCURACY OF ORIENTATION OF SOLAR POWER PLANTS ON SPACECRAFT

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 1, Jan 83
(manuscript received 19 Jan 82) pp 157-163

ARMAND, N. A., LOMAKIN, A. N. and PARAMONOV, B. M.

[Abstract] The problem of accurately orientating large solar power plants on spacecraft is analyzed from the standpoint of losses of microwave energy occurring in the process of its transmission from outer space to earth. The causes of losses, in addition to misalignment between the transmitter antenna in orbit and the receiver antenna on the ground, also include absorption and scattering in the atmosphere as well as incorrect orientation of the transmitter antenna and inaccurate evolvement of the amplitude-phase distribution in it. The total losses caused by atmospheric attenuation of radiation at a $\lambda \sim 10$ cm wavelength are estimated within 1.5% at zenith angles smaller than 80°. The losses caused by errors of the transmitter antenna are evaluated on the basis of geometrical and energy spectrum relation, assuming symmetry in the ideal case of the radiation spot falling on the center of the receiver antenna. Use of interferometers is considered for radiotechnical control of the orientating system. Installation of two radiointerferometers on the spacecraft has been proposed earlier. At present installation of two radiointerferometers on ground is proposed, with radiation from the transmitter antenna used for measurements. They can be spaced so as to be equivalent, in terms of accuracy, to a pair of orbiting ones when interference caused by turbulence in the atmosphere is also taken into account. Control of the plant orientation must not only be designed for maximum power transmission efficiency, which should not drop below 90%, but also allow for instability of the signal frequency and fluctuations of the antenna radiation pattern. This applies particularly to microwave instruments used in the control system

(amplitrons), their phase sensitivity and noise immunity. The authors thank V. I. Grigor'yevskiy for assisting with the calculations. Figures 3; tables 1; references 9: 5 Russian, 4 Western.
[151-2415]

UDC 537.874.4

MUTUALLY NONAMBIGUOUS CORRESPONDENCE BETWEEN IDEALLY CONDUCTING BODY AND FIELD SCATTERED BY IT

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 1, Jan 83
(manuscript received 22 Apr 81) pp 26-29

PONOMAREV, N. G.

[Abstract] Mutually nonambiguous correspondence between an ideally conducting body and the field scattered by it implies that to any such body of given shape, size and orientation, there corresponds a unique scattered field. A theorem is formulated accordingly, namely that an incident monochromatic electromagnetic field will be differently scattered by two finite bodies ideally conducting electric or magnetic currents but differing at least in shape, size or orientation. This theorem is proved with the aid of the uniqueness theorem for solutions to the Maxwell equations. It is proved for the case where the surfaces of the two bodies make no contact, with identical closed surfaces drawn for each body to separate the inside region from the outside region. The theorem is applicable to two bodies, one of which is an ideal electric conductor and one is an ideal magnetic conductor, as well as two bodies of which one is an ideal conductor and one is a dielectric. Nonambiguous correspondence between body and scattered field in the latter case can be established when the ideally conducting body completely contains the dielectric one, but not when the dielectric body completely contains the ideally conducting one. The author thanks Ya. N. Fel'd for his interest and helpful suggestions. Figures 2; references: 1 Russian.
[151-2415]

UDC 537.874.6:621.396.677

ELECTROMAGNETIC WAVE DIFFRACTION BY TWO-DIMENSIONALLY PERIODIC WAVEGUIDE-DIELECTRIC ARRAY

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 2, Feb 83
(manuscript received 30 Dec 81) pp 209-216

KREKHTUNOV, V. M. and TYULIN, V. A.

[Abstract] An analysis of methods of handling diffraction of electromagnetic waves by periodic dielectric structures shows that the use of stepped

dielectric rods has great possibilities for matching waveguide antenna arrays. In this paper a two-dimensionally periodic waveguide-dielectric structure of more general type is considered. It is assumed that the waveguides have a cross section of arbitrary shape and are located at the intersections of a nonorthogonal grid. In the space in front of the antenna aperture is a laminar inhomogeneous dielectric, the permittivity within the limits of each layer being described by a two-dimensionally periodic function of transverse coordinates. The method of projection splicing of fields in the planes of the joinings of longitudinally homogeneous regions is used to solve the problem for the case of quasi-periodic excitation of the array. An orthonormalized system of vector eigenfunctions of a transversely inhomogeneous Floquet channel constructed by the Galerkin method is used as the basis in the two-dimensionally periodic dielectric structure. The efficacy of the numerical solution of the proposed algorithm is studied on the basis of a calculation of the reflectivity of an incident wave from the aperture of an array of circular waveguides matched to free space by stepped dielectric rods. The results show that such rods are more effective for matching waveguide antennas than are cylindrical dielectric rods extending from the waveguides. The algorithm developed in the paper can be used for computerized design of an extensive class of radiating systems of phase waveguide antenna arrays. Figures 4; references 8: 7 Russian, 1 Western in translation.
[179-6610]

UDC 621.371.34

STRUCTURE CHARACTERISTIC OF REFRACTIVE INDEX FLUCTUATIONS ON INCLINED TROPOSPHERIC PATH

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 2, Feb 83 (manuscript received 2 Nov 81) pp 217-220

ARSEN'YAN, T. I., ZANDANOVA, G. I. and SEMENOV, A. A.

[Abstract] Experiments are conducted in order to determine the behavior of the structure constant of fluctuations in the index of refraction and the limits of applicability of different models of $C_n^2(h)$. Measurements were made on an inclined path of about 320 m with an angle of inclination of 27° under conditions of a large city. A source of optical emission with $\lambda = 0.6238$ μm. was located 165 m above ground level. The radiation was modulated by a mechanical interrupter and propagated through the atmosphere. The reception point was 25 m above ground level. The output signal from the reception photomultiplier was amplified and recorded by a chart pen. The measurement data were computer processed. The resultant statistical characteristics were used to evaluate the structure constant of fluctuations of the index of refraction of air under different experimental conditions. It was found that the values of $C_{nef.}^2$ determined from data on fluctuations of optical radiation are always higher than the theoretically expected values. Tables 4; references 9: 8 Russian, 1 Western.
[179-6610]

UDC 621.372.8.049.75:621.315.61

EXPERIMENTAL STUDY OF DIELECTRIC STRIPLINE WAVEGUIDE JUNCTIONS IN MILLIMETER WAVE BAND

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 2, Feb 83 (manuscript received 8 Sep 81) pp 397-399

VERSHININA, L. N.

[Abstract] Many components of integrated circuits based on a dielectric stripline waveguide in the millimeter wave band use waveguide junctions. Experimental work is important in design, because of the complexity of electrodynamic analysis on irregular sections of dielectric stripline waveguides. The author gives the results of an experimental investigation of a variety of junctions on a wavelength of 2.25 mm. The waveguide part of the striplines was made in the form of a Teflon strip measuring 1.9x 3.8 mm with $n_1 = 1.4$, and the substrates were made of Fluorolons with $n_2 = 1.24$ and 1.28. Two types of waveguides were studied: 1) With the strip contacting the substrate on the narrow side; and 2) On the broad side. Junction configurations that were studied included a break, intersection, right angle and directional coupling. The results show extensive capabilities of these couplings. Right-angle junctions with a reflector can replace bends as rotators, and intersections and directional couplers can be used in distributing, summing and regulating devices with widely ranging parameters. Figures 3; references 4: 3 Russian, 1 Western.
[179-6610]

UDC 621.396.67

REDUCING NUMBER OF ADAPTATION CHANNELS IN ANTENNA ARRAYS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 26, No 1, Jan 83 (manuscript received after revision 7 Dec 81) pp 42-46

SAMOYLENKO, V. I., GRUBRIN, I. V. and ZAROSHCHINSKIY, O. I.

[Abstract] A method of reducing the number of adaptation channels in radar antenna arrays is proposed which does not involve physically joining proximate elements into subarrays and does not result in "dead" adaptation zones. The gist of this method is first to determine the couplings between many input and few output channels, which means forming a new vector $y(t)= Ax(t)$ (A - rectangular mXn matrix, $m<n$), and then to process the signals as before into a weighted sum. An output signal now becomes $\beta(t) = v^T y(t)$, and the mismatch between output signals due to reduction of channels $\varepsilon(t) = u^T x$ must be minimized through optimization of the vector $u^T = w_{opt}^T - v^T A$ (w_{opt} - optimum weight vector for original array with adaptation along all n channels).

This, in turn, involves minimizing the sum of squares of the weight norms for the original array and proper selection of the A matrix for this purpose. The procedure is demonstrated on a linear array of four equidistant ($d = 0.5\lambda$) isotropic radiators subject to $l = 10$ different possible interference patterns, for which the number of adaptation channels has been reduced to $m = 2$ through numerical simulation on a digital computer. An advantage of this method over the simpler method of subarrays is that it utilizes the entire antenna aperture for formation of each partial channel. Figures 1; references 3: 1 Russian, 2 Western (1 in translation).
[150-2415]

UDC 621.396.67.01

ANALYSIS OF EMISSION CHARACTERISTICS OF APERTURE ANTENNA EXCITED BY PERIODIC PULSE SIGNAL

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 2, Feb 83
(manuscript received 3 Oct 80, after revision 13 Apr 82) pp 265-270

POLUKHIN, G. A.

[Abstract] The author considers radio systems with periodic r-f and microwave pulse carrier that enhance antenna directivity or permit a reduction in the dimensions of antenna apertures with retention of the directivity of radiation. A method of harmonic analysis is used in order to determine the energy characteristics of radiation of an aperture antenna in the form of a flat rectangular surface with cophased excitation by a pulsed carrier signal of the radio system. The signal takes the form of a series of trapezoidal pulses of alternating polarity. The method of analysis is based on the Huygens-Kirchhoff principle. It is shown that the frequencies of all harmonics, or of most of the harmonics of the spectrum of the pulse carrier must exceed the frequency of the sinusoidal carrier in order to obtain a gain in antenna directivity for equal average powers of pulsed and sine-wave signals. Figures 2; references 5: 4 Russian, 1 Western in translation.
[179-6610]

UDC 621.396.67.01:537.531

RADIATION FROM HORN ANTENNAS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 1, Jan 83
(manuscript received 18 Jan 82) pp 17-21

KALOSHIN, V. A. and EYDUS, A. G.

[Abstract] A horn antenna is considered at the termination of an open flat waveguide transmitting an E_{n0}-mode or H_{n0}-mode wave. Its radiation pattern and the reflection coefficient are calculated, taking into account higher-order

modes which appear as a result of diffraction of the waveguide mode at the waveguide-horn joint. The analysis is based on the two-dimensional model of a sectoral horn with end flanges at generally unequal angles to the waveguide axis, for which monomial and binomial asymptotic relations have been derived. The most important part is determining the boundary waves and their behavior. Calculations according to the geometrical theory of diffraction and according to the Kirchhoff method, both in the single-mode approximation, yield similar radiation patterns in terms of amplitude and phase profiles. They also agree with experimental data. No agreement with experimental data, even only qualitatively, has been obtained for the reflection coefficient and thus the two-dimensional model is not adequate here. The authors thank A. N. Drantsev for assisting with the experiment. Figures 2; references: 6 Russian.
[151-2415]

UDC 621.396.677.49

CHOOSING OPTIMUM RECTENNA DIPOLE DENSITY

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 2, Feb 83 (manuscript received 21 Jul 81) pp 362-365

BOYAKHCHYAN, G. P., VANKE, V. A. and LESOTA, S. K.

[Abstract] An important component of a microwave energy beaming system is the rectenna (rectifier-antenna) used for efficient reception and conversion of microwave energy to direct current. The rectenna is an antenna array of half-wave dipoles with independent loads arranged in parallel above a reflecting plane. The load for each dipole is a system of a matching microwave filter, rectifying Schottky diode, low-frequency filter and DC load. The authors consider the problem of selecting the optimum density of dipoles from the standpoint of economy, as the rectenna is a gigantic structure covering an area of up to 100 km^2 with the overall number of dipoles $\sim 10^{10}$. The analysis is based on a model of a rectenna that is infinite in extent and consists of simple homogeneous dipole-load cells. The dipole loads are taken as linear. It is assumed that a plane electromagnetic wave with optimum linear polarization is incident on this array. The method of induced emf's is used to calculate the current and power released in the dipole load. The efficiency of the rectenna is determined as the ratio of the power released in the dipole load to the power incident on the array, and the conditions of maximum efficiency are found. It is shown that the minimum density of vibrators corresponding to width of the radiation pattern of 10° is 80 dipoles per square meter. Such a dipole density is completely adequate for handling incident microwave power densities of up to 230 W/m^2. Figures 2, references 10: 4 Russian, 6 Western.
[179-6610]

UDC 621.396.677:519.85

APPLICATION OF MATHEMATICAL PROGRAMMING TO PROBLEMS OF DIFFRACTION SYNTHESIS OF ANTENNAS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 2, Feb 83 (manuscript received 16 Jul 79, after revision 28 Sep 81) pp 276-282

MARTSAFEY, V. V.

[Abstract] The problem of diffraction synthesis of antennas is considered with supplementary requirements of considerable suppression of the field in the shadow region. A numerical solution is found in two stages: solution of the direct problem of analysis in the rigorous diffraction formulation; optimization of antenna excitation. The antenna is a two-dimensional ideally conductive metal surface and an exciter. The conditions to be satisfied by the excitation vector are given, and the properties of the functions appearing in these conditions are explained. The solution procedure involves rigorous methods of accounting for the diffraction phenomena, and the use of mathematical programming to pick out the optimum solution. The technique is demonstrated by synthesizing an optimum exciter for a cylindrical antenna in which the field amplitude in the shadow region is minimized with some energy constraints. The Author thanks I. M. Polishchuk for helpful discussions and M. A. Solodovnikov for calculations. Figures 5; tables 1; references 19: 17 Russian, 2 Western (1 in translation).
[179-6610]

UDC 621.396.22:621.371.332.1:551.510.535

FLUCTUATIONS IN ANGLES OF EMERGENCE OF RADIO WAVES WITH SCATTERING IN SPHERICALLY LAMINAR IONOSPHERE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 2, Feb 83 (manuscript received 28 Oct 81) pp 392-394

YUKHMATOV, B. V.

[Abstract] The author considers the variance of angular fluctuations of a wave upon emergence from a parabolic scattering layer with isomeric inhomogeneities as a function of the ratio of the working frequency to the critical frequency of the layer for two models of altitude behavior of fluctuations in electron concentrations: 1) A model of constant variance; and 2) A model in which variance is proportional to the square of regular concentration. The model for analysis is based on oblique incidence of the wave on a spherical refracting layer with large-scale inhomogeneities having an isomeric correlation function. It is shown that variance of the angles of emergence is strongly dependent on the angle of incidence and that for large angles this dependence is stronger with consideration of curvature than in the planar case. Curvature of the ionosphere also affects variances of the azimuthal angle.

Accounting for sphericity of the ionosphere improves accuracy in choosing the optimum frequencies for long-distance radio communication, and may serve as a criterion for choosing the model of fluctuations in electron concentration. Figures 2; references: 5 Russian.
[179-6610]

UDC 621.396.22:621.371.332.1:551.510.535

INFLUENCE OF REFRACTION ON CAPTURE OF RADIO WAVES IN IONOSPHERIC WAVEGUIDE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 2, Feb 83 (manuscript received 11 Jun 81) pp 395-397

GUSEV, V. D. and YUKHMATOV, B. V.

[Abstract] The analysis of multiple scattering events is important for long-distance radio communications which uses the effects of excitation of the interlayer ionsopheric waveguide channel from the surface of the earth. The authors examine this problem with the influence of refraction on scattering peculiarities taken into consideration, and analyze the way that coefficients of capture depend on wave parameters, structure of inhomogeneities and regular properties of the ionosphere. The spatial and angular distribution of beams captured in the ionospheric waveguide channel are found by using a model of scattering by random inhomogeneities in the form of a Markov process. It is assumed that a plane wave of unit amplitude is incident on a plane laminar locally isotropic inhomogeneous ionosphere filling the upper half-space. Reflection from the boundary is disregarded. The coefficient of capture is found, and an investigation is made of the way that it depends on change of frequency, angle of incidence, the model profile of the ionosphere and scales of inhomogeneities. Two models of the ionosphere are considered, consisting of two and three layers; in each layer, the altitude behavior of the regular component of electron concentration is approximated by a parabola. The fluctuation part of electron concentration N_{1k} is approximated by the models $\overline{N_{1k}^2} = \text{const}$ and $\overline{(\delta N)^2} = \overline{N_{1k}^2}/\overline{N_{0k}^2} = \text{const}$, where N_{0k} is the maximum value of the deterministic part of electron concentration of the corresponding layer. The calculations show that the dependence of the coefficient of capture on angle of incidence is weak. The differences in the regular behavior of the index of refraction corresponding to diurnal variation of electron concentration change the coefficient of capture quite strongly (by a factor of about 30). The effectiveness of capture is optimum in the morning hours. Figures 2; references: 6 Russian.
[179-6610]

UDC 621.317.023

LOW-FREQUENCY ERROR OF MULTICHANNEL TIME-TO-PULSE CONVERTERS IN DIGITAL PHASE METERS

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 26, No 1, Jan 83 (manuscript received 27 Apr 81) pp 11-16

POKHILYUK, A. P., Vinnitsa Polytechnic Institute

[Abstract] An N-channel time-to-pulse converter for digital phase meters with constant measuring time can be optimized in terms of reduction of the high-frequency error component by a factor of N and the low-frequency error component by a factor of N^2, which is particularly useful in the case of the measuring time equal to several periods of the measured signal. In an optimum converter the channels are triggered either sequentially in angular steps of $2\pi/N$ or simultaneously with the phase intervals shifted by $2\pi/N$. The low-frequency error of such a converter depends on the error of angle $2\pi/N$ setting, as an analysis of its statistical characteristics indicates. Such an analysis, performed here by the spectral method, reveals that the normalized a priori unconditional error $\overline{\overline{\sigma^0(\Delta\gamma)F\theta}}$ ($\Delta\gamma$- phase error of channel triggering at frequency F,θ - length of measuring time) is a 2π - periodic function with a maximum when $\Delta\gamma = -2\pi/N + 2\pi p$ ($p \in 0,1,2,\ldots$), equal to the error of a single-channel converter, and with a minimum when $\Delta\gamma = 2\pi p$ corresponding to a relative frequency change of $F/F_0 = 1 + Np$. Accordingly, in measurement of the phase shift between signals of unknown frequency with a digital phase meter, the error $\overline{\overline{\sigma^0 F\theta}}$ of a time-to-pulse converter with channels triggered in equal intervals of time will vary from the maximum 26.8° to the minimum $26.8^\circ/N^2$. The mean error being $26.8^\circ/\sqrt{N}$, it is $\sqrt{N}$ times smaller than that of a single-channel device. The paper was recommended by the Department (Kafedra) of the Theoretical Basis of Radio Engineering, Vinnitsa Polytechnical Institute. Figures 3; references: 5 Russian.
[149-2415]

UDC 621.395.623.64:778.534.4

PROFESSIONAL HEADPHONES

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 1, Jan 83 pp 19-24

AMLINSKAYA, L. I., BURGOVA, Ye. V. and YUDIN, M. G., Central Motion Picture Equipment Design Office

[Abstract] The paper discusses electrical, acoustic and anthropometric design features of professional headphones used for sound film editing and quality control. Various types of circumaural and supra-aural earphones are discussed. It is shown that headsets with monoelectric transducers have the highest quality and fidelity of acoustic signal transmission. Isodynamic and orthodynamic systems are close contenders. Specific data are given on the 12A33 headset developed by the Central Motion Picture Equipment Design Office of "Ekran" Scientific Production Association. These phones have a range of reproducible frequencies of 20-20,000 Hz, a nominal level of sound pressure of 100 dB with respect to 20 μPa when power of 1 mW is applied to one earphone, divergence of frequency response within 1.5 dB, stereo DC impedance of 60 Ω, coefficient of nonlinear distortions of 1% and total mass of 500 g.
Figures 7, references 6: 1 Russian, 5 Western.
[174-6610]

UDC 621.397.231

IMPROVING EFFICIENCY OF TV CHANNELS

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 1, Jan 83 pp 42-46

ATAKHANOV, R. M. and MAKHMUDOV, E. B., "Kibernetika" Scientific Production Association, UzSSR Academy of Sciences

[Abstract] The paper describes experimental work being done in Uzbekistan to improve efficiency of utilizing TV channel capacity by a method of prediction and correction with linear prediction and limitation of a color TV signal. At the transmitting end of the line, a predicting device subtracts a predicted video signal $U_{pr}(t)$ from the initial signal $U_i(t)$ to form video signal $\varepsilon_t(t) = U_i(t) - U_{pr}(t)$. The signal $U_{pr}(t)$ is formed from delayed values of $U_i(t)$ added with appropriate weights. A correcting device on the receiving end with amplitude-frequency response (the inverse of that for the predicting device) reconstructs a signal $U_i'(t)$ close to the initial signal from $\varepsilon_t(t)$. As these operations are similar to differentiation and integration, the average power of signal $\varepsilon_t(t)$ is considerably less than that of $U_i(t)$. Because of high correlation between line elements, signal $U_{pr}(t)$ is very close on average to $U_i(t)$, and therefore the peak-to-peak amplitude of the transmitted signal

is near zero with a few spikes corresponding to abrupt changes in brightness and chrominance, which can be clipped since the eye is not critical to such distortions. Theoretical analysis and experimental studies establish optimum parameters for the predicting and correcting devices, giving a gain in signal-to-noise ratio of 8-9 dB with relatively simple circuitry and hardware. The proposed technique can be implemented by minor modifications of existing equipment. Figures 3, references 16: 15 Russian, 1 Western.
[174-6610]

UDC 621.397.611 videomagnitofon

OPTICAL FACILITY FOR MODELING CLOSED AUTOTRACKING SYSTEM

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 1, Jan 83 pp 46-49

SOSHNIKOV, V. G. and FRIDLYAND, I. V., All-Union Scientific Research Institute of Television and Radio Broadcasting

[Abstract] An autoscan tracking system is described in which the playback head of a video tape recorder is secured to one of the plates of a piezoelectric transducer that includes a bimorph pair with surface electrodes. The head is shifted by controlling voltage with amplitude which depends on displacement of the head relative to the recording line. An optical modeling facility is described for studying such autoscan tracking systems. The proposed unit uses a laser light source, telescope system, iris, mirror reflector, and piezoelectric transducer carrying a mirror reflector optically coupled with a diaphragm placed in front of a photocell. The optically coupled components form a luminous line in the plane of the diaphragm with slit equal in width to that of the line. Thus the photocell signal is maximum when the position of the luminous line coincides with that of the slit, and decreases with displacement from this position. This unit is completely analogous to the autotracking system, and can be used for studying the quality of autoscan tracking designs. Figures 8, references 7: 4 Russian, 3 Western.
[174-6610]

UDC 771.447:621.327.53

INVESTIGATION OF METAL HALIDE LAMPS WITH SHORT ARC

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 1, Jan 83 pp 15-19

DYBCHINSKI, V., FOBR "Tekhfil'm", Poland

[Abstract] Metal halide lamps with short arc produced by Osram with powers of 200-4000 W are studied in order to determine their electric and optical parameters: voltage, current, candlepower and chromaticity. It was found that the lamp voltage at the rated current is less than the value stated in the company catalog, and gradually increases as the lamps are used. Scatter of

candlepower for new lamps reaches 20% of the rated value. Candlepower decreases with time caused by discoloration of the lamp envelope rather than because of any change in electrical characteristics. Measurements of color temperature as a function of time showed that there is an initial decrease, after which the reduction in color temperature with time is much weaker. This is especially characteristic of 2500 W lamps. Figures 6; tables 2.
[174-6610]

UDC 771.537.611

RESOLUTION OF MOTION PICTURE LENS-CAMERA-FILM SYSTEM

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 1, Jan 83 pp 10-14

MIROSHNIKOV, A. I., Moscow Motion Picture Camera Plant

[Abstract] An investigation is made of the resolution of a lens-camera-film system, defined as the parameter $1/N_s = 1/N_{l-c} + 1/N_c = 1/N_{lens} + 1/N_f + 1/N_c$, where N_s, N_{l-c}, N_c, N_{lens} and N_f are the resolution of the lens-camera-film system, the lens-camera system, the camera, lens and film, respectively. Here N_s characterizes the resolution obtained in photographing a test pattern with the motion picture camera, N_{l-c} characterizes the resolution obtained in photographing the test pattern with the same lens in an ideal camera, and N_c characterizes the degree of influence that the dynamics of operation of the motion picture camera has on information transmission in the lens-camera-film system. It is shown that high precision in registration of the image plane with the light-sensitive film emulsion is a major factor in determination of N_s. The parameter N_s is suggested as an objective criterion for evaluating the quality of assembly and the technical condition of a motion picture camera in production and in use. Nonuniformity of the camera mechanism has a detrimental effect on system resolution. Figures 7; tables 4; references: 8 Russian.
[174-6610]

UDC 778.5:621.397.13 sistemy perevoda

RECORDING TV IMAGES ON MOTION PICTURE FILM WITH PARTIAL IMAGE STORAGE

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 1, Jan 83 pp 50-52

SEMENOV, V. M.

[Abstract] The author analyzes operation of a device for tape-to-film transfer with partial storage based on a 35-mm motion picture camera with shutter time reduced to 3.5-5.0 ms, and a kinescope with phosphor persistence that does not exceed a few milliseconds. Film exposure begins with the shutter open

at the instant of electron beam excitation of the kinescope screen, and continues because of persistence of the phosphor. Inasmuch as the shutter time exceeds the duration of the field quenching pulse, and the phosphor has a certain persistence, the shutter overlaps the luminous flux from two groups of lines of the TV frame: the upper lines of the first field, and the lower lines of the second field. It is shown that heightwise distribution of exposure and blackening density in such devices is generally nonuniform, the image distortions within the limits of the linear section of the characteristic curve being independent of recorded signal amplitude. Formulas derived in the article can be used in order to determine conditions that minimize image distortions in tape-to-film transfer, and to specify requirements for compensating filters. Figures 3, references 5: 4 Russian, 1 Western.
[174-6610]

UDC 621.372.85

TUNABLE FERRITE FILTERS USING WAVEGUIDE-DIELECTRIC RESONATORS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 26, No 1, Jan 83 (manuscript received 22 Dec 81) pp 25-31

KOROBKIN, V. A., PYATAK, N. I., DVADNENKO, V. Ya., MATYASHEV, V. V., DERZHAVIN, A. V., BABARIKA, L. I. and GRUTSYAK, V. I.

[Abstract] Ferrite microwave filters using a waveguide-dielectric resonator have electrical parameters comparable with those of gyromagnetic microwave filters and, moreover, are capable of operation far off ferromagnetic resonance at two-orders-of-magnitude higher power levels. The performance characteristics of two such filters for the 3-cm wave band have been calculated, one with a standard rectangular waveguide and one with a ridge waveguide, their reflection and transmission coefficients depending largely on the resonance characteristics of the inserted ferrite material. The performance of both filters using the low-loss 10SCh6B ferrite material falls within the same range in terms of maximum power level, losses inside the passband, attenuation outside the passband, bandwidth and slope of the amplitude-frequency characteristic. The tuning range (ΔF) is 1000 MHz for each, the frequency hysteresis (δf) is ± 5 and ± 1.0 MHz respectively. Frequency stability within ± 5 MHz over the $\pm 60^{\circ}C$ temperature range is achievable by means of automatic frequency control. Figures 6; tables 1; references: 7 Russian. [150-2415]

UDC 621.372.54.037.372

EFFECT OF FINITE BIT CAPACITY ON EFFICIENCY OF DIGITAL FILTERS FOR EXTRACTION OF SIGNALS SUBMERGED IN BACKGROUND INTERFERENCE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 1, Jan 83 (manuscript received 10 Apr 81) pp 86-90

MELESHKEVICH, A. N. and MIKHAYLYUKOV, V. N.

[Abstract] A linear filter (digital convolver) for processing wideband discrete signals is considered which has been synthesized according to the algorithm of fast discrete Fourier transformation. The effect of finite bit capacities of the arithmetic array and of the memory array on the efficiency

of such a filter is analyzed by a universal method which involves factorization of the filter response function into successive products of matrix elements and a vector. The errors arising in both arrays are evaluated through introduction of another matrix, this one of independent random numbers, with zero mathematical expectation and some dispersion. The maximum resulting loss of signal, normalized to the loss of signal in arrays with infinite bit capacities, is then calculated for the case of errors caused by the finiteness being much smaller than the useful signal. On this basis can then be determined the minimum capacities of the arrays for efficient signal detection. Numerical simulation of an N = 1024 convolver detecting a useful signal in the form of an M-sequence submerged in background interference with a given range-velocity distribution and white noise indicates that an 8-bit arithmetic array and a 12-bit memory array are needed for holding the loss of signal within 1 dB, with the algorithm of fast discrete Fourier transformation. A 7-bit memory array is needed for such a convolver with the algorithm of plain discrete Fourier transformation. Figures 2; references 9: 4 Russian, 5 Western.
[151-2415]

UDC 621.372.832.029.6

WIDEBAND POWER DIVIDERS-ADDERS ON NONHOMOGENEOUS TRANSMISSION LINES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 1, Jan 83
(manuscript received 27 Jul 81) pp 190-193

GORBACHEV, A. P., NEVEROV, S. G. and ROMANOV, A. N.

[Abstract] The frequency range of microwave power dividers-adders can be extended appreciably beyond an octave band, with a reduction of size, by using asymmetric directional couplers on coupled nonhomogeneous transmission lines instead of quarter-wavelength directional couplers. Such a structure can be designed for theoretically ideal matching of either input ports with the signal sources or output ports with the load circuits and ideal decoupling of channels throughout the entire frequency range. The design of these devices is based on the voltage amplitude and phase relations as well as on the frequency characteristics of crosstalk attenuation and insertion loss, all evaluated with the aid of the scattering matrix. It is furthermore expedient to equalize the amplitudes and alternately invert the phases of voltages across the ballast resistors. An experimental 5-channel device for a 4:1 frequency span was built on strip lines, nonhomogeneous ones coupled to single shielded symmetric ones on both sides of a 0.15 mm thick film between standard 3 mm thick sheets of FAF-4 material (dielectric constant ε_r = 2.2-2.5). In a test the total output of 3 W amplifiers was uniform within 0.5 dB, with the efficiency not dropping below 80% throughout the nominal frequency range but dropping slightly above that range and rapidly to zero below that range. Any differences between theoretical and experimental data can be attributed to dissipative losses, technological imprecision, nonidenticality of amplifiers, and imperfection of coaxial-strip joints. Figures 3; references 7: 5 Russian, 2 Western.
[151-2415]

UDC 621.37:512.217

CORRELATION FUNCTION AND SPECTRAL DENSITY OF CONTINUOUS-PHASE FREQUENCY-SHIFT-KEYED DISCRETE RADIO SIGNALS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 1, Jan 83
(manuscript received 3 Mar 80) pp 74-81

KHARISOV, V. N. and NGUYEN DANG MINH

[Abstract] Digital radio communication systems are more interference immune when transmitting continuous-phase frequency-shift-keyed signals

$$s(t) = A\cos\left[\omega_0 t+\int_0^t \omega(t_1)dt_1+\varphi_0\right]$$

(A - amplitude, ω_0 - carrier frequency, $\omega(t)$ - random keying frequency, φ_0 - random initial phase uniformly distributed over the $[-\pi,\pi]$ range, t - time) than when transmitting frequency-shift-keyed signals with phase discontinuity. Assuming that $\omega(t)$ is a stepwise random process with K possible fixed Ω_1 ($i = \overline{1,K}$) and step changes possible only at instants of time $t_n = nT+\Delta$ ($n = 0,1.2,\ldots$; T - constant known duration of stroke period, Δ-random quantity uniformly distributed over the [0,T] interval), both the correlation function and the spectral density of such signals are calculated with the aid of properties of stationary Markov sequences and narrow-band processes. The results are applied to signals with binary keying which correspond to a symmetric Markov chain. The authors thank V. I. Tikhonov for helpful comments. Figures 5; references 8: 2 Russian, 6 Western (1 in translation).
[151-2415]

UDC 621.391

SYNTHESIS OF OPTIMUM SIGNALS FOR SINGLE-CHANNEL DELAY SEARCH SYSTEMS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 1, Jan 83
(manuscript received 29 Aug 79, after revision 25 Dec 81) pp 52-59

BARANNIKOV, L. N., ZHODZISHSKIY, A. I. and NAUMOV, V. N.

[Abstract] The time necessary for determining the delay of a received signal depends on the method of search and on the form of the signal autocorrelation function. Here the problem of minimizing this time is solved by optimizing

the signal, namely by finding its optimum autocorrelation function among functions with a modulus of their first time derivative which does not increase with time. An additive mixture of signal with unknown delay and white normal noise with known spectral density is assumed to appear at the receiver. The optimum algorithm of delay search is constructed on the premise that the mathematical expectation of measurements will be determined by the readings of the signal autocorrelation function and assuming that the a posteriori probability density distribution of delay time will become a normal one even after the first measurement and even with an a priori uniform delay distribution over the signal period. A logarithmic signal autocorrelation function is found to be the optimum one in this case. A piecewise linear one with a logarithmic envelope is found to be the optimum one for delay search according to a quasi-optimum algorithm, the penalty being an only 45% longer search time. Figures 4; references 5: 4 Russian, 1 Western (in translation).
[151-2415]

UDC 621.391

PROPERTIES OF ARRAYS OF FREQUENCY-TIME SIGNALS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 1, Jan 83
(manuscript received 17 Mar 81) pp 82-85

PYSHKIN, I. M. and PANTIKYAN, R. T.

[Abstract] Asynchronous address systems with code multiplexing and code sharing use compound signals with both frequency-shift keying and time keying. Arrays of such signals must be synthesized with a least peaking cross-correlation function so as to ensure adequate interference immunity. Such arrays have already been synthesized on the basis of the theory of numbers or with the aid of t-diagrams and orthogonal tables. Here methods of algebraic coding in the f-t plane are proposed, with signal representation either by a time code or a frequency code. Each method is based on a theorem pertaining to the code with minimum Hemming intersignal distance in a corresponding array. Both theorems are proved and their analysis reveals that frequency coding is preferable because of a lower peak factor and simpler hardware implementation. Figures 2; references 6: 5 Russian, 1 Western (in translation).
[151-2415]

UDC 621.391

USING PHASE KEYING IN OPTICAL INCOHERENT CORRELATOR OF LINEAR FREQUENCY-MODULATED SIGNALS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 2, Feb 83 pp 312-317

SHISHARIN, A. V., MENSOV, S. N. and USLUGIN, N. F.

[Abstract] A method is considered for extending the dynamic range of an incoherent optical modulation correlator for analyzing linear frequency-modulated signals by a discrete shift in the initial phase of a reference signal. Recommendations are made on realization of the method with matched filtration of the center of the signal. Correlator parameters are estimated and results of experimental verification are given for modulation correlators with optical filter in the form of a disk with radial circular non-concentric black and white gratings, and with optical filter in the form of a moire pattern formed by superposition of circular and straight grids. The results show that the use of phase-antiphase shift keying in an incoherent optical correlator gives the desired filtration. Figures 3; references 6: 5 Russian, 1 Western (in translation).
[179-6610]

UDC 621.391.2:519.217

SYNCHRONIZING PHASE-KEYED SIGNALS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 2, Feb 83 (manuscript received 13 Apr 81) pp 283-289

VELICHKIN, A. I., IVANOV, A. V. and KHARISOV, V. N.

[Abstract] Synthesis of systems for synchronizing phase-keyed signals by methods of the Markov theory of optimum nonlinear filtration is usually done on the basis of quasi-optimum algorithms derived from an exact solution defined by the Stratonovich equation with Gaussian approximation, using a Taylor expansion at the point of evaluation of the nonlinear functions appearing in the equation. If the modulating function is a stepwise process, the derivative of the function will be a δ-function, making the resultant algorithms unworkable. Consequently, the authors consider the problem of studying algorithms of signal delay filtration that do not use nonlinear terms of the Stratonovich equation in the Taylor expansion. Such an algorithm is derived for filtration of the delay in the time of arrival of radio signals which are harmonic waveforms phase-shifted by 180° by a discrete double sequence. Figures 3; references 13: 11 Russian, 2 Western.
[179-6610]

UDC 621.391

STABILITY STUDY OF INERTIAL TWO-LOOP PSEUDORANDOM SIGNAL SYNCHRONIZATION SYSTEM

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 2, Feb 83 (manuscript received 17 Jun 81) pp 304-311

PONOMARENKO, V. P. and PANYSHEVA, G. F.

[Abstract] A numerical model is proposed for an inertial two-loop pseudorandom signal synchronization system which is based on combined operation of a phase synchronization and a delay synchronization system. An investigation is made of movements that disrupt stability of the system, and the stability boundaries are determined. An analysis is made of the influence that inertness of tracking subsystems has on the size of the stability region. It is shown that the stability of the system can be characterized by a certain region of capture to the synchronous mode with initial conditions from a defined region. Disruption of stability of the two-loop synchronization system is caused by a delay error beyond the discrimination characteristic of the delay tracking system, or occurrence of a periodic mode in the system. Curves are given that can be used to solve problems of optimizing the parameters of two-loop signal synchronization systems based on required stability with respect to initial mismatch and variation of parameters. Figures 9; references: 11 Russian.
[179-6610]

UDC 681.302

SYNTHESIS OF SYSTEMS FOR DATA PROCESSING AND ANALYSIS BY METHODS OF STRUCTURAL-PARAMETRIC ESTIMATION

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 26, No 1, Jan 83 (manuscript received 18 Sep 80) pp 7-10

RYSHKOV, Yu. P. and SUCHKOV, V. I.

[Abstract] A mathematical model is constructed which generalizes the processes of data formation and estimation in automatic control systems with incomplete a priori information about interference and its dynamics. The interference parameters as well as its structure and number of parameters are regarded as random quantities. The model, based on a shaping filter, includes the vector of state variables, the known control vector, and the input noise on each estimation (time discretization) step, with the control operator and the output operator producing functions which satisfy the Lipschitz condition. The problems of identification, observation, and filtration are combined into a single estimation problem, through proper extension of the state vector. This principle is then applied to parametrization of structural estimation problems and to synthesis of systems where one of $N<\infty$

possible interference structures with unknown parameters is expected to appear. The feasibility of synthesizing a system for data processing and analysis in such a case without introduction of an indeterminate generalized structure is demonstrated on the simple example of a sequential algorithm of structural-parametric testing of N different hypotheses about the probability density $W_i(\varepsilon)$ of a random quantity ε on the basis of its observed realizations.
References: 3 Russian.
[149-2415]

UDC 621.317.42

GENERALIZED METHOD OF CALCULATING CHARACTERISTICS OF PROFILED FERROMAGNETIC CORES MADE OF MATERIAL WITH SQUARE-LOOP HYSTERESIS

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 26, No 1, Jan 83 (manuscript received 8 Feb 82) pp 53-57

SHPADI, A. L. and SHPADI, S. L., Ul'yanovsk Polytechnic Institute

[Abstract] Calculation of the characteristics of profiled ferromagnetic cores made of material with square-loop hysteresis is very unwieldy when differential parameters are used and very inaccurate when step parameters are used. Here a method is proposed, both simple and accurate, which applies to almost any shape of core. It is based on the tanh-approximation of the magnetization curve and a shift of the argument by an amount equal to the coercive force. Both the coercive force and the maximum differential magnetic permeability of the material are defined taking into account their dependence on the speed of magnetization reversal. The magnetic flux and the magnetic field intensity are calculated accordingly, with the core profile function and the numbers of turns included. The calculations can be easily programmed on a medium-capacity digital computer such as the ODRA 1204, using an equivalent linear electrical circuit and the Duhamel integral for more convenient calculations in the time domain. The output characteristics of analog devices and of digital devices with ferromagnetic converter elements are obtained by this method in the same way, the only difference being the form of the output signal of the equivalent linear circuit. The paper was recommended by the Department (Kafedra) of Construction and Technology of the Production of Radio Engineering, Ul'yanovsk Polytechnic Institute. Figures 3; references: 6 Russian. [149-2415]

UDC 535.317.1

ANALYSIS AND SYNTHESIS OF REFRACTIVE-DIFFRACTIVE OPTICAL SYSTEM

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 26, No 1, Jan 83 (manuscript received 28 Dec 81) pp 99-101

SHITOV, V. G.

[Abstract] An optical system for holographic recording is considered which consists of a diffraction element (thin lens in plane of the aperture stop) and a refraction element (compound thick lens) placed coaxially some distance apart. The compounding of astigmatic aberration in this system with an array of light beams coming from the object, the reference source, the restoring source and going to the restored image is analyzed in terms of summation coefficients including the Abbe invariant and depending on the number of refracting surface, on the coordinates of the sources, on the radii and the distances. Synthesis of such an optical system for a given diffraction efficiency on the basis of aberration characteristics is possible by satisfying the Petzval condition as well as compensating the coma and the chromatism, which leads to a seventh-degree equation in the curvature of the first refracting surface or a tenth-degree equation in the thickness of the first refracting lens. An optical system of this type with a x30 magnification has been successfully synthesized for projecting an image from a laser screen ($\Delta\lambda = \pm 40$ Å), 50 mm in diameter with a resolution of 50 lines/mm and a distortion note exceeding 1%. Figures 1; references 4: 2 Russian, 2 Western (1 in translation).
[150-2415]

UDC 621.3.07-621.327.2

STATISTICAL CHARACTERISTICS OF FAULT DISTRIBUTION IN SEMICONDUCTOR MEMORIES

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 26, No 1, Jan 83 (manuscript received 11 Nov 81) pp 92-95

URBANOVICH, P. P., KONOPEL'KO, V. K., LOSEV, V. V. and SUKHOPAROV, A. I., Minsk Institute of Radio Engineering

[Abstract] Production of very large memories on semiconductor crystals for digital computers requires an adequate quality control of the technological

process, in order to ensure greater computer versatility without increasing the probability of memory failure. A study was made of the fault distribution in semiconductor crystals for a 4096-bit memory array. A total of 1215 samples grouped into 13 inspection lots was tested and the data analyzed statistically. The results have been processed so as to reveal the distribution of crystals and their 1-kbit quadrants with respect to the number of defects as well as the distribution of defects along rows and columns of the array. According to the Pearson chi-square criterion, these are not Poisson distributions. Most arrays have fewer than ten defective elements and crystals with three randomly spaced defects occur most frequently. With the mathematical expectations and the dispersions evaluated on this basis, it is possible to predict accurately the reliability of such a computer memory and estimate the cost effectiveness of redundancy built into it. The paper was recommended by the Department (Kafedra) of Radio Transmitting Devices and Radio Engineering Systems, Minsk Institute of Radio Engineering. Figures 2; references 4: 2 Russian, 2 Western (in translation).
[149-2415]

UDC 621.317.087.61

APPLICATION OF MICROPROCESSORS TO DIGITAL MEASUREMENT INSTRUMENTS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 7, Jul 81 pp 45-47

ORNATSKIY, P. P. and TSYVINSKIY, V. G.

[Abstract] A general discussion of the role and potential of microprocessors in digital instrumentation is followed by a cursory review of microprocessor applications in individual types of instruments. One of the most successful types of Soviet microprocessors is the K580 which has up to 111 instructions including variants of the base set, a word length of 8 bits, speed of 200,000 to 300,000 operations per second; the instruction format is 1, 2 and 3 bytes with an addressable memory of up to 64 Kbytes; the processor can handle up to 256 peripherals. A general purpose digital meter by Systron-Donner (U.S.) as well as a digital capacitance bridge by Boonton and the HP-1722A "thinking" oscilloscope by Hewlett-Packard are breifly described. The major tasks confronting digital instrument designers using microprocessors are: 1) The widescale implementation of structural design techniques where primary attention should be devoted to the realization of program (or microprogram) diagnostics at all levels; 2) The creation of a library of measurement algorithms for equalization, adaptation and other functions, designed for decimal arithmetic and a short word length; and 3) Careful resolution of the questions of the microprogram and hardware realization of a number of instrument functions (linearization, autoranging, etc.) and standardization of the most successful designs. Figures 2; references 4: 3 Russian, 1 Western.
[35-8225]

UDC 681.325.36

SYNTHESIS OF PARALLEL HIGH-SPEED GENERATORS OF PSEUDORANDOM NUMBERS

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 26, No 1, Jan 83 (manuscript received 27 Jul 80) pp 48-52

YARMOLIK, V. N., Minsk Institute of Radio Engineering

[Abstract] A method is developed for synthesizing a generator of pseudorandom numbers based on the general generating polynomial $\varphi(x) = 1+\alpha_1 x+\alpha_2 x^2+\ldots+\alpha_m x^m$ ($\alpha_i \in \{0,1\}$, $i = \overline{1,m}$). The performance of such a generator is described by the system of equations $a_1(k=1)= \bigoplus_{n=1}^{m} \alpha_n a_n(k)$ ($a_i(k+1)= a_{i-1}(k)$, $i= \overline{2,m}$, $k=0,1,2,\ldots$, $\oplus$ denoting summation in modulo 2). The generator consists of an array of D-triggers and adders. Its synthesis proceeds in two steps: first determining the set of coefficients $\delta_i(1)$ for $1= \overline{1,m}$ according to the recurrence relation $a_1(k=1)= \bigoplus_{i=1}^{m} \delta_i (1)\, a_i(k)$ from the corresponding system of logic equations and then constructing the functional diagram of the generator. The procedure is demonstrated on a parallel (high-speed) M-sequence generator with the generating polynomial $\varphi(x)= 1+x+x^3+x^4+x^5$. The paper was recommended by the Department (Kafedra) of Electrical Computing Machines, Minsk Institute of Electrical Machines. Figures 2; references: 2 Russian.
[149-2415]

DEVELOPMENT AND PRODUCTION OF RADIOELECTRONIC MEASURING DEVICES

Moscow EKONOMICHESKOYE SOTRUDNICHESTVO STRAN-CHLENOV SEV in Russian No 10, Oct 82 pp 21-24

ZIMAN, BOLESLAV, CEMA Secretariat

[Abstract] Development and production of unified Information and Measuring Systems have proceeded since 1971, when the Permanent CEMA Commission on Cooperation in Radio Engineering and Electronic Industry formulated guidelines for automation of measuring, inspection and testing processes. An important aspect of this system is interfacing with computers. Accordingly, development and production cover not only functional measuring devices, functional signal transmitting devices, auxiliary functional devices such as switching and matching ones, recording and data documenting devices but also minicomputers for data processing and program control, programmers, peripheral devices such as keypunch and storage, and software in the form of data banks. As computer programming languages have been selected "Minimal Basic" and FORTRAN-4, also "Pascal" have been recommended for future applications. The

two essential features of this cooperative development and production project are: 1) division of tasks and product lines between member countries (USSR, CSSR, GDR, Poland, Hungary, and Bulgaria since 1978) according to where each specializes and excels; 2) coordination with bilateral or multilateral inspection and testing for compatibility of system components. A major objective is to utilize latest inventions and discoveries, to implement new technologies in production of radioelectronic devices and new methods of data processing. Major emphasis is on further improvement of digital measuring techniques and incorporation of microprocessors in measuring instruments.
[147-2415]

MICROCOMPUTER PROGRAMMING FOR RADIO AMATEURS

Moscow RADIO in Russian No 11, Nov 82 pp 38-41

ZELENKO, G., PANOV, V. and POPOV, S.

[Abstract] The article is one in a series devoted to explaining the workings of microprocessors and microcomputers to radio amateurs. The first two articles appeared in RADIO, 1982, No 9, 10. The process of programming a microcomputer is explained by detailed examination of each step involved in compiling a program for using a microprocessor to solve a simple problem in pushbutton control of two LEDs: extinguishing one LED and activating the other for a period of 0.25 s, followed by a delay of 0.5 s when the device will not respond to the pushbutton switch signal. This simple task includes elements of flowcharting, memory addressing, subprogramming, conditional branching, decision making and many other operations. Figures 2; tables 1.
[129-6610]

UDC 621.396.668

STABILITY OF PULSE-PHASE AUTOMATIC CONTROL SYSTEM WITH TRIGGER-TYPE PHASE DETECTOR AND INTEGRATOR

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 26, No 1, Jan 83 (manuscript received 17 Mar 82) pp 35-40

KUZNETSOV, A. P., Minsk Institute of Radio Engineering

[Abstract] A pulse-phase system of automatic frequency control is considered which contains a trigger as phase detector followed by an integrator, the latter feeding the control element of the tuned oscillator through a proportionally integrating filter. The equation of the trigger-detector is

$$k_2 \int_{\tau_n}^{T+\tau_{n+1}} x(t)dt=2\pi$$

(T - period of driving signal, k_2 - frequency quotient in feedback circuit, $x(t)$ - frequency of tuning oscillator, τ_n and τ_{n+1} durations of width-modulated rectangular pulses within a period). The stability of this system is analyzed, and the conditions for its stability are established, on the basis of its steady-state and transient response to an input signal constituting a sequence of unit step functions. Calculations are based on a transfer function of the continuous linear part of the system (integrator - filter - control element) in the form of a sum of simple fractions. The paper was recommended by the Department (Kafedra) of the Theoretical Basis of Electrical Engineering, Minsk Institute of Radio Engineering. Figures 2; references: 3 Russian.
[149-2415]

UDC 537.226.029.66.047

DIELECTRIC PROPERTIES OF LIQUIDS AT SUBMILLIMETER WAVELENGTHS (REVIEW)

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 1, Jan 83
(manuscript received 30 Dec 81) pp 1-16

APLETALIN, V. N., GARIN, B. M. and MERIAKRI, V. V.

[Abstract] The dielectric permittivity at submillimeter wavelengths is usually measured by quasi-optical methods which utilize the exact interrelation between the complex dielectric permittivity, the complex refractive index, and the absorption coefficient as well as the exact relation between the complex dielectric permittivity and the time autocorrelation function, its classical or quantum version, of the dipole moment. The formalism of memory functions offers a convenient way of constructing correlation functions and spectral relations for dielectrics. Experimental methods of studying liquid dielectrics at submillimeter wavelengths essentially include Fourier spectroscopy (interferometry) and laser spectroscopy, which have been developed abroad. Use of backward-wave tubes as oscillators, with smooth automatic frequency control, and n-InSb crystals as detectors with quasi-optical lens arrays as beamguides for the measuring channel has been developed in the Soviet Union by the Institute of Radio Engineering and Electronics, USSR Academy of Sciences. The technique of measurement and the equipment components can be tailored to each class of dielectric liquid in terms of absorption characteristics within the frequency range corresponding to submillimeter wavelengths. From this standpoint, dielectric liquids are classified into high-absorption polar ones, simple or associated (with hydrogen bonds), and low-absorption nonpolar ones. Separately from pure liquids are treated solutions, a distinction being made between solutions of polar liquids in nonpolar solvents, aqueous solutions of organic compounds, and aqueous solutions of salts. Each particular measurement technique is generally based on and matched with known theoretical or semiempirical models of a given type of liquid. The authors thank B. Z. Katsenelenbaum for his interest in the work and V. I. Gayduk and Yu. P. Kalmykov for helpful discussions. Figures 3; tables 7; references 167: 40 Russian, 127 Western (5 in translation). [151-2415]

UDC 535.312

DEVICE FOR DYNAMIC VARIATION OF MIRROR FOCAL LENGTH

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 11, Nov 82 (manuscript received 24 Dec 81) pp 60-61

KHODTSEV, S. P.

[Abstract] An optical range-scanning element is described in which the focal length of a flexible reflective surface is periodically changed by varying its radius of curvature. The reflective surface is a magnetic sheet in the field of an electromagnet powered by alternating current. An analysis is made of the shape of the reflective surface considered as an oscillating elastic membrane clamped around the periphery. Curves are given for the behavior of deflection as a function of supply frequency and as a function of supply power. Figures 4; references: 3 Russian.
[176-6610]

UDC 535:621.375.029.6

OPTIMIZATION OF OPTICAL RECEIVER FOR DIRECT DETECTION OF HIGH-FREQUENCY AND MICROWAVE ANALOG SIGNALS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 1, Jan 83 (manuscript received 27 Nov 80) pp 168-172

SHVARTS, N. Z. and BROVKO, G. M.

[Abstract] The performance of optical receivers for direct (noncoherent) photo-detection of analog signals depends on the degree of distortion of the modulating signal, this distortion determining the signal-to-noise ratio. Optimization of such a receiver involves minimization of the luminosity which will yield the required signal-to-noise ratio. The procedure is demonstrated on a receiver comprising an array of avalanche photodiodes capable of processing microwave signals. General relations are established for a receiver of AM signals which include a noise current generator in the equivalent circuit and an amplifier following the detector stage. These relations describe the signal-to-noise ratio and the power of the optical signal on the basis of which the effects of various noise components can be evaluated comparatively

and from which the optimizable parameters can be extracted. The threshold power for a photoreceiver is found to be proportional to $\sqrt{\Delta f}$, $\sqrt[3]{I_d}$, $\sqrt{TFG_{ph}}$ in the current-limited mode and to $\sqrt[4]{\Delta f^3}$, $\sqrt[4]{TFG_{ph}}$ in the signal-limited mode (Δf-noise band passed by amplifier, I_d - dark current, T - absolute temperature of photodiode, G_{ph} - electrical conductance of photodiode, F - noise factor of amplifier). Optimization of the photoreceiver sensitivity accordingly, in addition to cooling involves minimization of the product FG_{ph}, which in the case of a narrow-band receiver can be done at a fixed frequency with the output susceptance easily compensated. In the case of a wideband receiver optimization is more difficult and the problem then is to minimize a deviation function, either the sum of squares if weighted deviations from nominal at several frequencies or the maximum deviation at whichever frequency it occurs. Figures 1; references 6: 2 Russian, 4 Western.
[151-2415]

UDC 621.3.032.266

ELECTROSTATIC DEFLECTING COMPONENTS THAT DO NOT PRODUCE ABERRATION FOURFOLDS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 2, Feb 83
(manuscript received 10 Jun 81) pp 357-361

DODIN, A. L.

[Abstract] The practical value of raster electron-optical systems is dependent on the aberrations introduced by deflectors. Such aberrations can be reduced if the aberration expression takes into consideration so-called fourfold terms caused by the symmetry of the deflectors with rotation about the axis of the system by one fourth of a full turn. These terms can be eliminated by using correcting elements; however, adding components to the system is always undesirable. Therefore, an examination is made in this paper of the feasibility of making deflectors that do not produce aberration fourfolds. Various types of electrostatic deflectors of this kind are found, using two approaches: 1) Elimination of the third harmonic of the electrostatic field potential in the vicinity of the z-axis of the system; and 2) Use of an electrostatic element formed by identical symmetric electrodes arranged about the axis of symmetry of the system in such a way that the plane of symmetry of each electrode passes through the axis of the system, and each electrode is produced by rotating its neighbor through the same angle. Figures 4, references 7: 2 Russian, 5 Western.
[179-6610]

UDC 621.375.7

TRAVELING-WAVE PARAMETRIC AMPLIFIER WITH LOWER PUMPING FREQUENCY

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 1, Jan 83
(manuscript received 30 Nov 81) pp 114-120

MARCHENKO, V. F., STREL'TSOV, A. M. and ZHMUROV, S. Ye.

[Abstract] A traveling-wave microwave parametric amplifier with three-wave (degenerate four-wave) interaction and cubically nonlinear voltage (current) dependence of charge (magnetic flux) $Q= C_1V+ C_3V^3$ is described which consists of a low-pass filter with a pair of MOS variable capacitors. It features a discretely distributed structure and a lower pumping frequency than that for a parametric amplifier with quadratic nonlinearity. Its performance is analyzed first in the linear approximation, with harmonic pumping and lossless transmission. The saturation mode is considered next, assuming that saturation of gain at high pumping amplitudes is caused by saturation of the variable capacitance. In the nonlinear mode of operation, with the necessary boundary conditions for the amplitudes of the three waves, there is found to be no optimum signal phase at the amplifier input. Operation with an appreciable dispersion of the retarding system is determined largely by the attenuation of all waves. Experimental data obtained with a transmission line consisting of 45 such amplifier stages at a signal frequency of 5.9 MHz and a pumping frequency of 7.2 MHz agree closely with theoretical data on signal spectrum and gain. The authors thank V. M. Lopukhin for helpful discussion. Figures 5; tables 1; references 8: 5 Russian, 3 Western (1 in translation). [151-2415]

UDC 621.382.2

SOME ANOMALIES IN NOISE CHARACTERISTICS OF GUNN-EFFECT DIODES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 1, Jan 83
(manuscript received 30 Jun 81) pp 203-204

PROKHOROV, E. D. and SKOROBOGATOVA, S. N.

[Abstract] An experimental study was made of semiconductor diode structures with hot charge carriers and with a static strong-field domain at the cathode in which band-band impact ionization can occur. Specimens of n-GaAs ($n_0= 6.5\cdot10^{15}$ cm^{-3}) films expitaxially grown on semiinsulating substrates were used for measurement of the current-voltage characteristics of microwave noise and the spectral noise power density as a function of the bias voltage at various frequencies, with the diodes and a matched load inside a waveguide. In weak fields the current-voltage characteristics were almost symmetric, indicating the absence of p-n junctions. The data indicate a nonmonotonic dependence of the microwave noise level on the bias voltage, with the noise

power peaking twice at any frequency. As the frequency is increased, the peaks occur at higher bias voltage and also shift farther apart. These results can be interpreted in terms of an impact-avalanche effect in the static domain at the cathode of such a Gunn-effect diode and can serve as a basis for optimizing the operation of this diode for constant noise level over a wide frequency range. Figures 1; references: 4 Russian.
[151-2415]

UDC 621.382:537.312

PHENOMENOLOGICAL ANALYSIS OF INJECTION-TYPE AMPLIFICATION

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 1, Jan 83
(manuscript received 22 Jul 80, after revision 25 Jan 82) pp 148-150

GARIN, B. M.

[Abstract] Injection-type amplification, i.e., multiplication of the photocurrent is analyzed in terms of gain, the latter being defined as ratio of sensitivity of an injection device (long forward-biased diode) to that of an injectionless device (resistor) with identical geometry to an input signal of any kind and differential sensitivity being considered here. The method of analysis is phenomenological, based on the form of the current-voltage characteristics. Calculations involve, accordingly, parameters of the current-voltage curves, particularly their slopes, and dimensional parameters of the devices as well as parameters characterizing the signal. In the steady-state case consideration is given to: 1) Amplification through internal feedback, possible only when the transconductance of the injection device is much higher than that of the injectionless device coupled to it; and 2) Amplification caused by the effect of a signal on the electrical conductivity (with change in current disregarded). In the transient case the "dynamic" gain is calculated for an alternating signal with small modulation amplitude. The current-voltage characteristics and their dependence on the signal parameter can be determined either theoretically or experimentally for gain calculation by this method. The author thanks V. I. Stafeyev, N. B. Zaletayev and Ye. V. Kulikov for helpful discussions and comments. References: 8 Russian.
[151-2415]

UDC 621.382.2:621.372.8

EFFECT OF HIGHER-ORDER OSCILLATION MODES ON CHARACTERISTICS OF WAVEGUIDE-TYPE p-i-n-DIODE CONTROL DEVICES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 1, Jan 83
(manuscript received 24 Aug 81) pp 201-203

VINENKO, V. G., USANOV, D. A. and LITSOV, A. A.

[Abstract] In many waveguide-type control devices with p-i-n diodes the latter are placed in gaps between retaining metal stubs at the waveguide walls. The performance of such devices can be affected by higher-order modes, especially when these retainer gaps are narrow. Here the effect of higher-order modes is analyzed in the case of a cutout switch with two p-i-n diodes at opposite walls of a rectangular waveguide. Calculations, based on the matrix of input and mutual impedances in the equivalent II-network with the corresponding transmission matrix, are shown for specific waveguide dimensions with retainer gaps varied. These calculations reveal an only weak dependence of the cutout insertion loss on the gap width in the diode retainers. A comparison of these theoretical results with the single-mode approximation characterized by a resonance-type frequency dependence and with experimental data reveals that excitation of higher-order modes reduces the cutout insertion loss and tends to make it frequency independent. Figures 3; references 5: 3 Russian, 2 Western.
[151-2415]

UDC 621.385.6.001.24

INVESTIGATION OF RING-BAR SLOW-WAVE SYSTEM

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 2, Feb 83
(manuscript received 20 Oct 81) pp 257-264

LOSHAKOV, L. N., IVANOVA, N. Ye., PIS'MENKO, V. F. and MOZGODOY, Yu. D.

[Abstract] The ring-bar slow-wave system is extensively used in power traveling-wave tubes and linear amplifiers. Analysis of such systems based on the solution of electromagnetic field equations gives results that agree with experimental data only for small phase shifts of the zero (working) spatial harmonic for the period of the system (in the region of long waves), and are very different from experimental data for phase shifts close to π. This paper offers an approximate method of analysis based on a combination of solutions of electromagnetic field equations and selection of the form of current distribution on the conductors of the ring-bar system. Nonuniform current distribution is assumed on the rings of the system, which is in better agreement with reality than the uniform distribution conventionally assumed, because the ring is a section of line with equivalent wave impedance decreasing toward the branching side, and reaching a minimum at the point equidistant from the

bars. An analysis is also made of a slow-wave ring-bar line in an anisotropic shield with longitudinal conductivity, and a system of dispersion equations is derived for the case of electron flux inside the line. Figures 5; references: 7 Russian.
[179-6610]

UDC 681.787:778.39:621.315.592

DETERMINING INHOMOGENEITIES OF SEMICONDUCTOR MATERIALS IN INFRARED SPECTRAL REGION

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 12, Dec 82 (manuscript received 28 Oct 81) pp 29-32

BEKETOVA, A. K., GOROKHOVA, I. Yu., SHISHOV, Ye. I. and MAMONTOV, A. M.

[Abstract] The authors consider the feasibility and prospects for using shadow and interference methods in order to study inhomogeneities of semiconductor materials in the far infrared, using an LG-22 laser (λ = 10.6 μm). Shadow patterns of inhomogeneities produced by a shadow instrument under laboratory conditions are given for plane- parallel plates of single-crystal germanium and a solid solution of $Cd_xHg_{1-x}Te$ with values of x ranging from 0.19 to 0.26. The gradient of the index of refraction is determined from the experimental data. A comparative evaluation is done on optical methods of visualization as applied to studying inhomogeneities of materials in the infrared spectral region. It is shown that the interference pattern characterizes deformation of the wave front solely due to variation of the index of refraction. The shadow pattern shows the distribution of the coefficient of absorption. Use of a Foucault knife can reveal variations of the shadow pattern, and give precise information on angular scattering properties of the material. Thus the combined use of these different techniques gives quite complete information on inhomogeneities of semiconductor materials. Figures 4; references 13: 8 Russian, 5 Western.
[177-6610]

UDC 389.14:531.71.08:681.7:006.354.003

METROLOGICAL SUPPORT FOR INSTRUMENTS TO MEASURE DEVIATIONS FROM LINEARITY AND FLATNESS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 7, Jul 81 pp 25-26

MEDYANTSEVA, L. L., LEONOV, V. V. and GORBACHEVA, V. V.

[Abstract] Since hundreds of thousands of special gauges and tools for the measurement of deviations from flatness and linearity are in use in industry, particularly the machine building and metal machining sectors, a questionnaire was sent out to the organs of the State Metrological Service in order to determine the products list and number of such tools presently in service, and to study the calibration standards being applied. Some 90 organizations provided data on the number of the following types of tools in service, as well as their calibration checking frequency and number of support organizations providing calibration services: 1) Master linearity and flatness gauges of various classes, 2) Test plates, 3) Optical rules, and Microlevels as well as hydrostatic levels and optical linearity gauges. Data summarized in tabular form indicates that there is no single instrument which measures flatness and linearity deviations which is completely tested and calibrated (only 60% of Class 0 and Class 1 ShM master gauge rules are tested, which must be corrected since these rules are the calibration standards for type ShP and ShD rules). The relevant State Standards which are under review are indicated and it is noted that work is underway at the present time in the Sverdlovsk affiliate of the All-Union Scientific Research Institute for Metrology (VNIIM) on the creation of a special state calibration standard and testing scheme for tools which measure such deviations. Tables 2; references: 3 Russian.
[35-8225]

UDC 535.241

LIMITATION OF INTERFERENCE NOISES IN OPTICAL MEASUREMENT SYSTEMS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 11, Nov 82 (manuscript received 29 Mar 82) pp 13-14

BUKHSHTAB, M. A.

[Abstract] An analysis is made of the way that measurements of luminous flux are influenced by the interference pattern which arises upon reflection from interfaces in cases where the difference between reflectivities of the faces makes the Airy formula inapplicable. Relations are derived for the visibility of the interference pattern that arises with different reflectivities of interfaces of optical components, and it is shown that interference effects can be minimized. It is experimentally confirmed that the influence of radiation interference on accuracy of optical measurements can be considerably reduced by correcting the distribution of reflectivity of the interfaces of optical components. Figures 1, tables 1, references: 4 Russian.
[176-6610]

UDC 536.6:681.883

MEASURING TEMPERATURE STABILITY OF PIEZOELECTRIC HYDROPHONE SENSITIVITY

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 7, Jul 81 pp 50-51

BELASHCHENKO, G. I., PAVLOV, L. Ye., SIL'VESTROV, S. V. and SMIRNOV, B. P.

[Abstract] The sensitivity of a GI-7 hydrophone, designed for use as a calibration standard, is studied as a function of temperature in a range of 0 to 40° C. Schematics of both the hydrophone and test configuration are shown; the results of both direct and indirect measurements of the sensitivity of hydrophones with two types of piezoelectric transducers between 1 Hz and 10^4 Hz show good agreement. For hydrophones with a TsTS-19 piezoelectric material in the transducer, the sensitivity varied linearly with a temperature coefficient of -0.013 dB/°C, while the same figure for TsTSStBS-1 transducers was -0.015 dB/°C. The hydrophone designs and piezoceramic materials studied here satisfy the requirements placed on calibration standard hydrophones as regards temperature stability. Figures 3; references 4: 3 Russian, 1 Western.
[35-8225]

UDC 550.3/8:53.08

TESTING RELIEF AND LEVELING SURFACES HAVING LARGE AREA

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 7, Jul 81 pp 27-29

KOZLOV, V. V., ZAVODOV, Yu. K. and SASHINA, L. A.

[Abstract] A technique for checking surface relief of an area of up to 2,000 m^2 is proposed and experimentally proved; it allows the detection of relief variations of about 0.002 mm and practically completely eliminates subjective errors in the reading of the measurements. This represents an improvement of nearly an order of magnitude over the 0.01 mm error attainable with the MN-1 or MN-2 microlevels. The method, which can be automated, employs an LG-52-3 laser, prisms driven by an electric motor as well as a photosensitive diode target transducer and the requisite electronic data processing circuitry. The laser beam is focused to a spot with a diameter of 10 to 50 micrometers on the target, which has the shape of an isoceles triangle. The beam is scanned across the transducer by the rotation of the prism, where the driving electric motor is regulated to have an angular velocity stable within 0.1% or less. The intervening relief between the laser and the transducer is measured by indirectly measuring the vertical travel of the target transducer; calculations show that to measure relief rises with an error of no more than one micrometer where the distance between the laser and the transducer is 10^4 mm, the error in setting the distance of the transducer from the laser should not be more than ± 8 mm. The technique significantly reduces the time for testing large surface areas, significantly increases the precision and makes the results independent of the ambient temperature. Figures 2; references: 3 Russian.
[35-8225]

UDC 621.375.826:535.411

MEASURING DISPLACEMENTS OF OBJECT WITH RESPECT TO SIX COORDINATES BY LASER DIFFERENTIAL METHOD

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 12, Dec 82 (manuscript received 26 Jan 82) pp 5-7

BYKOV, A. P., VUSTENKO, V. I. and LYUBOMUDROV, O. V.,

[Abstract] The laser differential method of measuring displacements of an object is simple and accurate, and permits variation of measurement sensitivity over a wide range. Soviet and U.S. patents date back 10 years for instruments that use this method for measuring displacements of an object in translational motion with respect to one or two coordinates. In this paper, the differential method is extended to the general case of displacement of an object with respect to six coordinates. An expression is derived for the relation between phase of the optical signal and displacements, and it is

shown that displacements of an object with respect to six coordinates can be found by solving six such equations. The method of realization involves installing six appropriately oriented rasters on the object, and introducing the same number of optical and electronic channels. A device is described for implementing this principle with a unit for shaping six differently oriented pairs of laser beams. A movable unit consisting of a rigid frame carrying three two-coordinate rasters is installed so that the rasters are in the zones of intersection of the beams. Behind each raster are two orthogonal photocells that record radiation with mutually orthogonal direction of the plane of polarization. The output signals from the photocells are processed by a six-channel phase-measurement device with reversible counting of cycles. The device has a relative error of linear displacements of no more than $2.5 \cdot 10^{-5}$ in a range of 0-80 mm. Realtive error of measurement of angular displacements is $2 \cdot 10^{-5}$ rad for a range of 0-0.05 rad with distance of 400 mm between two parallel rasters. Figures 3, references 4: 3 Russian, 1 Western. [177-6610]

UDC 621.383.8

FEASIBILITY OF MUTUAL COMPENSATION OF NOISE AND CONTRAST-FREQUENCY CHARACTERISTICS OF IMAGE CONVERTER

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 12, Dec 82 (manuscript received 11 Nov 81) pp 40-41

EDEL'SHTEYN, Yu. G., MATSKOVSKAYA, Yu. Z. and SAVENCHUK, N. A.

[Abstract] The paper gives the results of experimental verification of the possibility of mutual compensation of the influence on visibility of noise and frequency-contrast characteristics of an image converter in the region of illuminances where the threshold properties of the "image converter-eye" system are determined by quantum fluctuations of light. The experiments were done on a cascade image converter with coefficient of conversion of 500,000, photocathode sensitivity of 330μA/lu, and resolution limit of 29 mm^{-1}. A change in the signal-to-noise ratio of the image converter was accompanied by a corresponding change in the frequency-contrast characteristic so that the working resolution remained nearly constant at about 9.5 mm^{-1}. The signal-to-noise ratio was varied by changing the illuminance of the photocathode, and the frequency-contrast characteristic was changed by defocusing the electron lens of the second chamber of the image converter. It was found that increasing the signal-to-noise ratio of the image converter relaxes the requirements for the frequency-contrast characteristic (and vice versa), confirming the feasibility of mutual compensation of the given parameters in the region of illuminances where fluctuational patterns of the converter/eye perception are operational. Constant resolution at system amplification $m \geq 10$ corresponds to a constant value of the generalizing parameter P_N which accounts for the noise and structural properties of the image. This parameter is the

product of the signal-to-noise ratio of the image converter and the contrast transfer coefficient on the corresponding spatial frequency. Figures 2, tables 1; references 6: 4 Russian, 2 Western.
[177-6610]

UDC 621.384.3

THERMAL EMITTERS FOR DETERMINING THERMOGRAPH PARAMETERS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 12, Dec 82 (manuscript received 2 Apr 82) pp 42-43

SHABASHEV, O. K. and MURAVEYSKAYA, A. A.

[Abstract] A description is given of the RP-728 and RP-729 low-temperature emitters designed for producing "standard" heat fields in checking the major characteristics of medical thermographs. The devices reproduce a heat field in the form of a circle with diameter of 50 and 100 mm. Energy brightness is maintained at 11 fixed levels corresponding to radiation temperature ranging from +26°C to +36°C. The emitters proper are copper disks 5 mm thick coated with AK-243 flat black enamel. Heating is by a bifilar Archimedes spiral uniformly distributed over the back side of the emitter. The temperature sensors are STZ-19 thermal resistors. Coefficient of emission of the working surface is at least 0.97, and temperature calibration is within $\pm$0.2°C. Error of radiation temperature reproduction caused by variation of ambient temperature $^{\circ}C/^{\circ}C_{amb} = 0.05$, and that caused by $\pm$10% variation of the line voltage is 0.02°C. Time to reach steady-state operation is 2.5-3 minutes. Figures 2; references: 3 Russian.
[177-6610]

UDC 621.385.8

MEASURING RATIO OF CONCENTRATIONS OF ELEMENTS IN SEA WATER BY FLAME PHOTOMETER

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 12, Dec 82 (manuscript received 18 Feb 82) pp 54-56

VASILENKO, V. V., LYSKOV, V. G. and SIDORENKO, V. M.

[Abstract] It is shown that the possibilities for using single-channel flame photometers in the study of concentrations of elements in sea water are limited by the accuracy of measurements. The error of measurement of absolute concentrations depends on the coordinates of the photometrically studied zone of flame combustion, nonuniformity of gas feed to the burner, nonuniformity of admission of the solution being analyzed and variation of solution temperature. When determining relative concentrations of elements, the contribution of these errors to experimental results can be reduced by switching from

sequential measurements of absolute intensities of emission lines to direct determination of their ratio. The authors describe a two-channel facility for operation on this principle. The instrument consists of two commercial flame photometers. The base photometer is for excitation of the spectrum in the gas flame and registration of one of the elements in the emitting solution. The optoelectronic components of the second unit set up an additional channel for the base unit. The results of experiments with the proposed two-channel system show that the accuracy of determining ratios of concentrations of elements in sea water is improved considerably by the system as compared with a single-channel flame photometer. Figures 2; table 1; references: 6 Russian.
[177-6610]

UDC 621.396.67

EFFECT OF MECHANICAL VIBRATIONS OF VELOMETER ON ACCURACY OF MOTION MEASUREMENT IN FRESNEL ZONE

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 26, No 1, Jan 83 (manuscript received 26 Apr 82) pp 101-104

SHELUKHIN, V. I. and KERNOV, Yu. P.

[Abstract] The accuracy of measuring the velocity of a moving object with a Doppler instrument which operates in the Fresnel zone is evaluated, taking into account mechanical vibrations of the instrument. It is assumed, specifically, that the instrument mounted on the object measures the horizontal velocity $V_h(t)$ while vibrating in the vertical plane at a radial velocity $V_r(t)$. The electric field intensity $E(t)$ at the receiver input is calculated accordingly. The results of this analysis are applied to an automobile radar system, where vibrations of the speedometer can be characterized by amplitude $A(x_0,y_0)$ and phase $\Omega(t)$ so that the radial component of velocity becomes $V_r = A(x_0,y_0)\cos \Omega t$. An analysis of the resulting expression for the electric field intensity reveals the terms due to vertical vibration modulate the amplitude of the received signal. The condition for 100% modulation is equivalent to an amplitude $A = 0.07\lambda$, at which frequency readings will be missed and the instrument becomes inaccurate. Therefore, the amplitude of vertical vibrations should not exceed 0.02 cm or 0.056 cm for instruments operating at wavelengths $\lambda = 3$ mm and $\lambda = 8$ mm respectively. Mechanical vibrations also appear to generate combination (sum and difference) Doppler frequencies. Figures 1; references 3: 2 Russian, 1 Western.
[150-2415]

UDC 629.7.058

ERROR OF RADIO ALTIMETERS IN MEASUREMENT OF VERTICAL SURFACE PROFILE

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 26, No 1, Jan 83 (manuscript received 16 Dec 81) pp 56-60

CHIZHOV, V. I.

[Abstract] Measurement of the vertical surface profile with a radio altimeter is analyzed for accuracy. A surface is represented as a composite of random small-scale and large-scale structures with given correlation radii and dispersions. Reflection of radio waves by these structures is included through introduction of the local backscattering diagram, in the Kirchhoff approximation, and construction of the one-dimensional reciprocal indeterminacy function for reflected signal and expected signal in the radio altimeter receiver on the basis of the Gaussian approximation of the antenna radiation pattern. A measurement then reduces to location of this reciprocal indeterminacy function in time. This is done by estimating the location of its leading edge in the case of pulse-type radio altimeters and by estimating the location of its maximum or center of gravity in the case of radio altimeters with frequency modulation, the latter type of instrument including a narrow-band and a wide-band frequency discriminator. Disregarding additive noise and Doppler fluctuations, the errors and their correlation functions are determined by the estimator bias. The bias here is as if two components were not exactly the same magnitude in each case, one produced by changes in width and one produced by angular evolution of the local backscattering diagram during flight. The error is generally largest in estimating the location of the center of gravity. Figures 1; references 7: 4 Russian, 3 Western (2 in translation).
[150-2415]

UDC 681.332.6:621.317.6

DIGITAL SWEPT-TUNED SPECTRUM ANALYZER

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 7, Jul 81 pp 20-22

CHAYKOVSKIY, V. I. and KRAKOVSKIY, V. Ya.

[Abstract] Real time swept-tuned spectrum analyzers which realize the Fourier transform of the input signal exhibit the best arithmetical efficiency when the following recurrence relationship is employed:

$$F_q(p) = [F_{q-1}(p) + \frac{1}{N}(f_q - f_{q-N})]\exp(j\frac{2\pi}{N}p)$$

where q is the dimensionless sweep frequency index (number of the incoming signal readout), p is the dimensionless frequency (number of the harmonic) and N is the dimensionality of the observation vector (the number of input sequence readouts being considered simultaneously). Equations are derived

from the above for the real and imaginary components of the swept-tuned spectrum and their application to practical spectrum analyzers is illustrated by three block diagrams. Configurations for the analysis of both real and imaginary signal components are described in order to show that such analyzers which make active use of the available pauses are substantially simpler than the well-known fast Fourier transform processors; with the same speed for the execution of typical computer operations provide for a swept-tuned real time spectrum analysis with a frequency range which is greater by a factor of $(1/2)\log_2 N$ times. Experience with the use of standard series produced K133 and K186 IC's confirms the feasibility of real time signal processing in a working frequency range of up to 1-2 KHz with a maximum possible analysis interval width of up to 512-1,024 complex readouts. The technique is particularly effective in multichannel matched filtration systems. Figures 3; references: 3 Russian.
[35-8225]

UDC 666.1.056:535.4

HIGH-REFLECTIVITY METAL-DIELECTRIC MIRRORS BASED ON COPPER

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 12, Dec 82 (manuscript received 17 Sep 81) pp 36-38

BULATOV, N. N., IVANOVA, L. A., PRIDATKO, G. D. and RUDINA, O. G.

[Abstract] A high-frequency ion-plasma sputtering technique is used for producing metal-dielectric coatings on a copper base for mirrors with high reflectivity from the visible to the infrared region of the spectrum. Opaque layers of copper 0.15 μm thick were applied directly on glass backings by high-frequency sputtering of copper in spectrally pure argon. The copper base was covered by a system of protective and interference layers of silicon dioxide and titanium dioxide. Such mirrors show an appreciable gain in spectral reflection in the region of 400-650 nm over gold and copper coatings. At longer wavelengths the reflectivities coincide with the analogous characteristics of copper coatings ($R \tilde{=} 98\%$). High-reflectivity Cu-SiO_2 and Cu-SiO_2-TiO_2 mirrors withstand high humidity (98% at +40°C) for 10 days without any change in spectral characteristics. They were also successfully tested with thermal shock cycles of ± 60°C. These mirrors are suggested as replacements for expensive low-strength gold reflectors used in instrument making. Figures 2, references 4: 3 Russian, 1 Western.
[177-6610]

UDC 621.317.44.089.08:389.14

STANDARD MAGNETIC PERMEABILITY SAMPLE FOR MEASUREMENTS OF FERROMAGNET CHARACTERISTICS AT HIGH AND MICROWAVE FREQUENCIES

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 7, Jul 81 pp 68-69

CHERNOUSOVA, N. N.

[Abstract] Samples of carbonyl iron as promising material for calibration standard magnetic permeability samples were studied under identical ambient conditions (temperature and pressure) for stability over a period of 10 years, while ferrite samples were studied for 5 years. With appropriate storage, the permeability changes less than 1% during this time. The following frequencies were chosen for the certification of the materials: 1, 5, 10, 20, 60, 100, 150 and 200 MHz. The stability was studied with temperature fluctuations in a range of 20 + 5°C. The real component of the magnetic permeability in this temperature range does not vary more than 1% in this case. Six types of certified standards were produced as a result of these studies of carbonyl iron and high frequency ferrites. References: 3 Russian. [35-8225]

UDC 621.318.134.029.64

DISPERSION CHARACTERISTICS OF MAGNETOSTATIC WAVES IN COMPOUND FERRITE-DIELECTRIC-METAL STRUCTURES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 1, Jan 83 (manuscript received 26 May 81) pp 121-126

NOVIKOV, G. M., BORISOV, S. A. [deceased], DUBOVITSKIY, S. A. and PETRUN'KIN, Ye. Z.

[Abstract] A method is proposed for experimentally studying the dispersion characteristics of magnetostatic waves, specifically for measuring the frequency dependence of their phase and group velocities. The gist of this method is to apply a wideband signal $f(t)$ with a complex spectrum $S(\omega) = \int_{-\infty}^{\infty} f(t)e^{-j\omega t}dt$ synphasally to the input and the output of the device in which

magnetostatic waves propagate. The part of the signal carried by a magnetostatic wave will be delayed so that at the output there will appear a resultant spectrum of two signals $S(\omega) = (1+e^{-j\omega\tau})S(\omega)$. The principle of this method is based on the delay theorem and the theoretical relation for the spectral energy density of such a resultant signal. The method was tested on surface magnetostatic waves in three-layer FDM structures (F- ferrite, D-dielectric, M- metal) consisting of iron-yttrium garnet wafers or films with the [111] axis perpendicular to the direction of wave propagation on gallium-gadolinum garnet substrate with metal coating on the other surface and in five-layer MDFDM structures with thick ferrite layer. The experiment has revealed forward surface magnetostatic waves coexisting with backward ones in a five-layer structure. A theoretical model is proposed describing the experiment, derivation of the corresponding dispersion equation being based on simultaneous solution of the Maxwell equations in the magnetostatic approximation and the Landau-Lifshits equation for magnetization of a lossless isotropic ferrite in a layer of two-dimensional finiteness. The results of the experiment confirm the feasibility of controlling the dispersion characteristics of surface magnetostatic waves over a wide range through variation of the width of the dielectric gap (thickness of the dielectric layer between ferrite and metal). The authors thank S. G. Suchkov and A. G. Lazerson for programming the calculation of the dispersion characteristics. Figures 5; references 10: 4 Russian, 6 Western.
[151-2415]

UDC 621.372.85

VOLUME AND SURFACE MAGNETOSTATIC WAVES IN METALLIZED STRUCTURE WITH TWO FERRITE FILMS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 26, No 1, Jan 83 (manuscript received after completion 25 Feb 82) pp 36-42

BEREGOV, A. S.

[Abstract] The spectrum of volume and surface magnetostatic waves in a plane-parallel multilayer structure containing two isotropic ferrite films is analyzed, assuming this structure to be a five-layer D_1-F_1-D_2-F_2-D_3 one (D-dielectric, F-ferrite) with metallization on both sides and placed in a constant magnetic field of arbitrary orientation. The general wave equation is derived from Maxwell's field equations in the magnetostatic approximation with appropriate boundary conditions. The permeability tensor for the isotropic ferrite films is derived from the equation of magnetization propagation, disregarding attenuation and volume interaction. The dispersion characteristics evaluated numerically, with a wide variation of parameters, reveal an appreciable degree of controllability for a variety of applications. A practical example is the feasibility of designing special-purpose delay lines such as for processing linearly frequency modulated signals without a special gradiental bias magnetizing field. Figures 5; references 14: 6 Russian. 8 Western.
[150-2415]

UDC 621.372

DESIGN OF HALF-WAVELENGTH RESONATOR WITH VARACTOR TUNING

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 26, No 1, Jan 83 (manuscript received after revision 12 Apr 82) pp 87-89

RYZHAKOV, S. M. and ROTKOV, L. Yu.

[Abstract] The design of a half-wavelength microwave resonator with varactor tuning is outlined on the basis of an equivalent circuit where the oscillator transistor has been replaced by its collector-base capacitance and the varactor diode in parallel has been replaced by a series L-C-r branch (L- inductance of lead wires, C- capacitance of p-n junction, r- loss resistance). The telegraph equations for transmission of a TEM-mode wave and the resonance equation for such a wave in this circuit yield a transcendental parametric equation in normalized variables, the numerical solution to which can be represented in graphical form. The resulting curves indicate the effects of varactor wiring inductance and of transistor output capacitance on the resonator characteristics, namely both increase the frequency span ratio $K_f = f_{max}/f_{min}$ and the inductance also increases the normalized resonance wavelength. The equivalent resistance at resonance can be increased or decreased by appropriate adjustment of the transistor inclusion factor. The design procedure is to select, first the transistor and varactor, which fixes the collector-base capacitance, the varactor capacitance span ratio $K_C = C_{max}/C_{min}$, then select the other circuit parameters accordingly and calculate the equation parameters, finally calculate the characteristic impedance and the length of the resonator, whereupon the frequency range and the variation of the equivalent resonance resistance over this range can be found from the curves. Figures 2; references 4: 2 Russian, 2 Western.
[150-2415]

UDC 621.372.2.001.24

ANALYSIS AND SYNTHESIS OF SEMICONDUCTOR HALF-WAVELENGTH RING BRIDGE

Kiev IZVESTIYA UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 26, No 1, Jan 83 (manuscript received after revision 10 Mar 82) pp 47-51

GVOZDEV, V. I., KANONIDA, K. Kh., KHITROV, S. S. and CHERNUSHENKO, A. M.

[Abstract] Half-wavelength ring bridges for microwave devices are proposed with arms of them comprising transmission lines of different types. Without sacrifice of an octave bandwidth, such bridges are shorter and more technological than bridges with transmission lines of one type in all arms. Being smaller in size, such a bridge leaves room on the strip board for connections to external matching devices which can extend the frequency range to several octaves. A particular version of such a bridge is shown which consists of two quarter-wavelength segments of an asymmetric slot line bent into a ring, a microstrip line connected in parallel with it forming one input arm, a symmetric slot line connected in series with it forming another input arm, and two parallel microstrip lines forming the output arms. The operation of this device is analogous to that of synphasal-antiphasal hybrid devices. Its performance is analyzed here by the method of mirror images and its characteristics are calculated from the scattering matrix. The elements of its transmission matrix are of the form $T_{jk}= (1-s^2)^{-n/2}P_{jk}(s)$ ($j,k= 1,2,\ldots$, s- Richards variable, $P_{jk}(s)$- Richards polynomials in s with real coefficients). Synthesis on this basis is possible for a specific mode of excitation. In a specific example the results of such a synthesis agree within 3% with those of synthesis by the method of indeterminate coefficients. The frequency range can be extended by means of identical reciprocal two-pole networks connected one to each bridge arm, their impedance designed so that the reflection coefficient, in the Chebyshev approximation deviates minimally from unity throughout the entire frequency range. Figures 3; tables 2; references: 6 Russian.
[150-2415]

UDC 621.372.826

PLANAR TRANSMISSION LINES USING MULTILAYER DIELECTRIC

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 26, No 1, Jan 83 (manuscript received 16 Dec 81) pp 31-36

MALYSHEV, M. N. and MIRONENKO, I. G.

[Abstract] Planar microwave transmission lines using high-permittivity dielectrics are adaptable to circuit integration, multilayer dielectric structures being particularly advantageous. The phase velocity of waves is lowered appreciably in waveguides formed by a thin film (h= 2-10 μm) of ferroelectric material with an anomalously high dielectric constant ($\varepsilon>10^3$) on a ceramic

substrate. The performance characteristics of such devices are most conveniently and rather accurately calculated in the TEM-modes approximation, assuming an infinitely thick substrate. In the coplanar type of the waveguide the ferroelectric film is metal (copper) coated and two parallel grooves in the coating separate the center strip electrode from the outer sheet electrodes. It features a small frequency dispersion. The losses increase with decreasing width of the center electrode and with decreasing width of the grooves, while increasing the width of the grooves will make the running waveguide capacitance dependent also on the substrate characteristics. In the planar two-conductor type of transmission line two parallel metal (copper) strip electrodes are deposited on the ferroelectric film. The equivalent dielectric constant increases as the electrodes are brought closer together, but the dissipative losses increase both with decreasing width of the electrodes and with decreasing separation between them. The results of theoretical analysis have been confirmed by numerical estimates and experimental data. Figures 5; references 8: 6 Russian, 2 Western.
[150-2415]

UDC 621.372.832.01

INVESTIGATION OF 3-dB INTERDIGITAL MICROSTRIP COUPLERS WITH ADDITIONAL DIELECTRIC LAYER

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 2, Feb 83 (manuscript received 20 Jul 81) pp 271-275

KARTAZHOV, V. B. and LUPULYAK, V. V.

[Abstract] An analysis is made of ways to increase the electric strength of interdigital three-decibel directional couplers that consist of four pairwise connected coupled microstrip lines. Gaps between stripline conductors of the order of 70-75 μm enable use of such devices at relatively high power levels. A further increase in electric strength and improvement of technological properties of such couplers can be achieved by adding a dielectric layer over the stripline conductors. The increase in electrical strength is caused by the introduction of a solid dielectric with high breakdown voltage between the conductors, as well as to some widening of the gaps. The additional dielectric also equalizes the phase velocities of the even and odd waves of the coupled stripline system, thereby improving decoupling. A variational method is used in combination with a method of integral transforms to calculate the characteristics of such directional couplers in the TEM approximation. It is shown that the solid dielectric should be a film of material with permittivity of the order of 3-4 to meet practical requirements. Experiments with arylox film (permittivity of 2.6) confirm the calculations. Figures 3; tables 1; references 3: 1 Russian, 2 Western.
[179-6610]

UDC 621.373.5

SELECTION OF VARACTOR FOR DESIGN OF TUNABLE MICROWAVE OSCILLATOR

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 26, No 1, Jan 83 (manuscript received after revision 25 May 82) pp 89-91

MACHUSSKIY, Ye. A.

[Abstract] Proper selection of the varactor diode is essential for successful design of a tunable microwave oscillator. A nomogram is proposed which facilitates this selection for a given frequency range on the basis of known values of four varactor parameters: capacitance and inductance of varactor case, capacitance and loss resistance of semiconductor structure. The nomogram is presented in the form of curves of inclusion factor p (ratio of average energy stored in variable diode capacitance to total energy stored in given circuit) vs. operating frequency normalized to series-resonance frequency f/f_{ser}. The parallel-resonance frequency is also normalized to the series-resonance frequency and the ratio of case capacitance to semiconductor capacitance is aligned with f_{par}/f_{ser} on a separate nomogram. The five-step algorithm of varactor selection is demonstrated on a typical example of the five different varactors available, the best one to be selected for a center frequency of 30 GHz with a tuning range of 3 GHz. Figures 1; tables 1; references: 2 Russian.
[150-2415]

UDC 621.373.832

MATCHING TRANSFORMERS FOR WAVEGUIDES PARTLY FILLED WITH FERROELECTRIC MATERIAL

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 26, No 1, Jan 83 (manuscript received 8 Dec 81) pp 19-25

KONONOV, M. V., KOSHEVAYA, S. V. and OMEL'YANENKO, M. Yu.

[Abstract] Waveguides partly filled with ferroelectric material such as $SrTiO_3$ (dielectric constant $\varepsilon_R = 300$ at 293 K) combine low losses with high-power concentration at relatively low frequencies, such a large dielectric constant contributing to a low characteristic impedance of the waveguide and a large slowdown of waves. However, in a semiinfinitely long waveguide with almost all the field contained within the ferroelectric medium a strong reflection of waves at the end occurs, so that matching of such a waveguide becomes difficult. Here the problem is approached considering the diffraction of waves by a one-step inhomogeneity, with a matching transformer plate (dielectric constant ε_T) inserted at the free end and with a fundamental TE_{10}-mode incident wave assumed to be coming from the empty waveguide. The analysis is based on cylindrical symmetry and corresponding expansion of the field components E_y, H_x into series in eigenfunction $F_m(x)e^{-j\gamma_m z}$. Calculations are

based on the one-wave initial approximation and are made for three regions: before, along, and behind the transformer plate. Collocation of the field at the two boundaries of the transformer plate yields a doubly infinite system of linear equations for the unknown field amplitudes within the transformer plate region. Numerical results for three different plates (ε_T= 300, 95, 32) indicate that the reflection coefficient can be minimized through optimum selection of the plate dimensions, with both thickness and width varied in the case of large slowdown or with the plate thickness fixed in the one-wave approximation and only the plate width varied in the case of small partial reflection coefficients. Such a transformer with an effective dielectric constant of the order of 300 yields an SWR <1.1 and has a smooth amplitude frequency characteristic, unlike that of a smoothly tapered transition. Figures 6; tables 1; references 7: 3 Russian, 4 Western (2 in translation).
[150-2415]

UDC 621.376.42

BROADBAND DISCRETE MICROWAVE PHASE MODULATOR

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 26, No 1, Jan 83 (manuscript received after revision 18 May 82) pp 83-85

KALININ, V. A., MAKARENKO, A. S. and TOLSTIKOV, Yu. V.

[Abstract] A broadband multiposition (discrete) phase modulator is synthesized by cascading of phase shifters, each with a low-pass and a high-pass filter. Phase shifters with maximum possible bandwidth are used and the number of commutating stages matches the required mode of operation in a definite time sequence. Typically, an 8-step approximation of a saw-tooth phase characteristic for frequency shifting in radar systems or phase keying in digital communication systems can be attained by cascading three phase shifters with a 45-90-180° phase discretization, each forming a T- or II-network with a low-pass and a high-pass filter. Microwave phase modulators of this kind are preferably built with p-i-n diodes and strip lines or microstrip lines, utilizing the diode capacitance as a filter component. Computer calculations of design and performance are based on A-matrix and S-matrix coefficients, and they must take into account phase lead buildup along the transmission line segments. Figures 2; tables 1; references 2: 1 Russian, 1 Western.
[150-2415]

UDC 621.382.2.029.64

SIGNAL CHARACTERISTICS OF AUTODYNE GUNN-DIODE PHOTOCONDUCTIVE RECEIVER WITH SELF-DETECTION

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 2, Feb 83
(manuscript received 13 Mar 81) pp 380-386

DOKTOREVICH, M. M. and SHINKARENKO, V. G.

[Abstract] The authors determine the region of stable limited space-charge accumulation signals of a Gunn-diode microwave oscillator, with consideration given to both the microwave circuitry of the oscillator and the power supply conditions. It is shown that an increase in the internal impedance of the supply source results in considerable constriction of the region of stable oscillations as compared with the region of existence of the limited space-charge accumulation mode. An analysis is made of the signal characteristics (photoresponse and passband) of an autodyne photoconductive receiver based on a Gunn-diode oscillator when the photosignal is detected by the Gunn diode. The signal characteristics of such a receiver are compared for diode supply by a current generator and by a voltage oscillator. When a current generator is used, a change in amplitude (load) produces sharp changes in photoresponse because of proximity to the stability boundary. In the case of a voltage oscillator, the entire region of existence of the limited space-charge accumulation mode is stable and changes of photoresponse are slow. Curves for the receiver passband, as a function of generator amplitude with supply by a source with high internal impedance, show a maximum, in contrast to the monotonic behavior observed with supply by a source with low internal impedance. Figures 5, references 4: 3 Russian, 1 Western.
[179-6610]

UDC 621.382.2.029.6

FEASIBILITY OF MICROWAVE OSCILLATION ACCOMPANYING AVALANCHE PROCESSES IN DIPOLE DOMAINS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 2, Feb 83
(manuscript received 29 Sep 81) pp 387-391

KOSTYLEV, S. A., POGORELAYA, L. M. and PRIVALOV, V. N.

[Abstract] An examination is made of the possibilities of avalanche generation of charge carriers localized in the domain of a strong electric field as a basis for achieving high-frequency oscillations. Experiments on avalanche processes in long Gunn diodes have shown multiple-domain modes and have given rise to high-power oscillations on frequencies considerably exceeding the domain drift frequency. In this paper, these effects are attributed to non-uniform accumulation of charge carriers. It is assumed that in the initial stages of development of avalanche processes this mechanism gives rise to a virtual anode mode, then to a mode of many virtual electrodes, and in the

final stage to a virtual cathode mode. The conditions that bring about this virtual electrode behavior are examined. The theoretical predictions were verified in an experiment with specimens $5 \cdot 10^{-4}$ m in length, drift frequency of 200 MHz, and a corresponding power of 0.3 W. The specimens were placed in a tunable coaxial resonator with frequency range of 0.5-6 GHz. In the range of voltages corresponding to current increase through the specimen, there was an abrupt increase in frequency to 5 GHz, and in output power to 10 W, i.e., there was an increase by an order of magnitude in the efficiency of conversion of DC voltage to AC voltage. The authors thank Yu.F. Sokolova for valuable comments expressed in reading the manuscript, and N. B. Gorev and I. I. Sokolovskiy for assistance to the work. Figures 3; references 17: 9 Russian, 8 Western.
[179-6610]

UDC 621.383.52

FREQUENCY CONVERSION OF RADIATION MODULATION IN AVALANCHE PHOTODIODES WITH MICROWAVE BIASING

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 11, Nov 82 (manuscript received 28 May 81) pp 18-21

YAKOVLEV, V. V.

[Abstract] The paper gives the results of a theoretical analysis of the maximum coefficient of power transfer of an avalanche photodiode with microwave biasing. This analysis is used as photosensors in phase phototachymeters, an important factor is stability of the working point, which can affect both the amplitude and phase of the output signal. An experimental curve is given showing the way that I-F signal phase depends on biasing voltage at radiation modulation frequency of 760 MHz. To prevent errors from avalanche photodiodes exceeding 0.5°, the working point must be held within (10-15) mV of the optimum value. Figures 3, references 7: 3 Russian, 4 Western.
[176-6610]

UDC 621.316.11.004.18

DAMAGES FROM POWER FAILURE AT A PLASTICS PLANT

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 9, Sep 82 (manuscript received 16 Feb 82) pp 1054-1057

[Article by I. V. Kovanova and B. V. Papkov]

[Text] The authors give a method for estimating the aftereffects caused by failures of electric power supply to technological processes of a plastics plant. They show an approach for construcing calculated models and collecting initial data, as well as the results of calculating damages from stopping delivery of various types of power carriers to these production areas.

The plastics plant at which studies were conducted consisted of two technological sections. The production sections which are being analyzed are unique. Up to the present time, no evaluation of damages caused by failure of electric power to these production sections has been done.

The solution of this problem presupposes the development of a functional scheme of the enterprise and construction on its basis of economic-mathematical models of the interruption of production processes when electric power supply in the scheme is suddenly cut off. The availability of such models for individual production sections makes it possible to obtain the necessary evaluations of damages for various modes of functioning of the power supply circuit for a given enterprise and perform such calculations on analog enterprises using the methods of imitative simulation.

As a result of studies, it was revealed that the plant in question is a consumer of a large number of various power carriers. They are produced and distributed by means of special general plant power installations which are very big consumers of electric energy and whose share in the total electric power consumption is about 70%. Therefore, in order to examine the problems of reliability of the power supply system and modes of its operation under emergency conditions, it is necessary to analyze the aftereffects occurring on technological objects when one or another power carrier stops delivering power.

Situations connected with power supply failure of both production areas are accompanied by the action of technological blocking which ensures damage-free stopping.

The construction and analysis of the scheme of power and technological connections of the plant (Figure 1) showed that independently operating technological production sections are rigidly connected with the power units of the enterprise. Therefore, any failure in the system of its power supply could lead to stopping technological processes and stopping of the plant-wide objects.

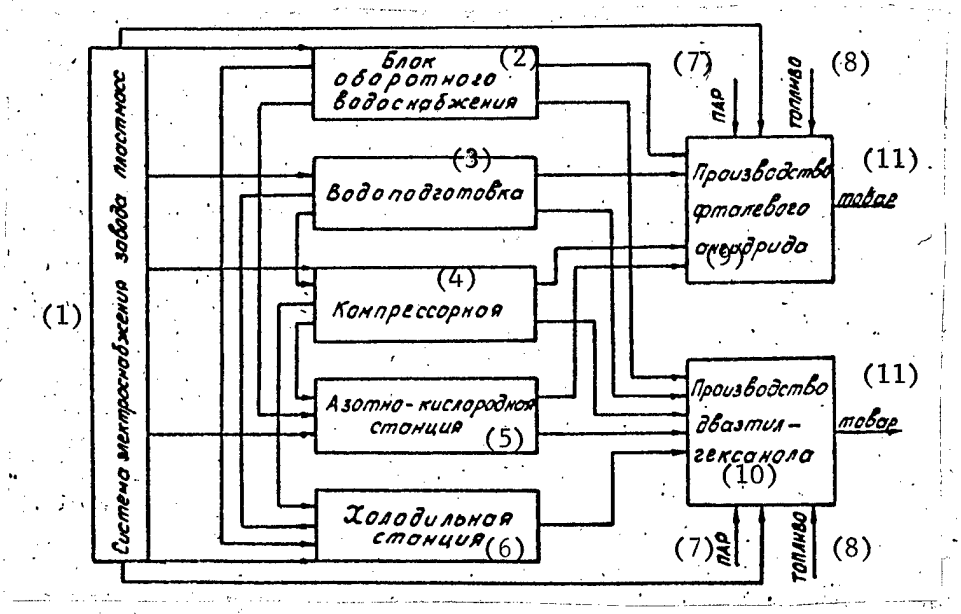

Figure 1. Scheme of Energotechnological Connections of the Plant

Key: 1. Electric power supply system of the plastics plant
2. Circulating water supply unit
3. Water treatment
4. Compressor room
5. Nitrogen-oxygen station
6. Cooling station
7. Steam
8. Fuel
9. Phthalic anhydride production
10. Two-ethyl hexanol production
11. Merchandise

Interruption of power supply reflects on the work of technological sections if its length $t_{эн}$ is greater than a certain critical time t_o which depends on inertial characteristics of each production plant. The length of failure in the power supply of the technological section by various power carriers (with the exception of electric energy) depends on the value of $t_э$ -- interruption in the electric power supply of the general plant installation. Therefore, the dependence $t_{эн} = f(t_э)$ must be taken into consideration in determining the functions $t_{тхн} = F(t_э)$. After the restoration of the power supply, the technological process is adjusted. In the production of phthalic anhydride, failure of power supply caused by any power carrier requires such adjustment in the course of 40 hours at $t_э$ = 1 hour and 50 hours at $t_э$ = 2 hours. In the production of two-ethyl hexanol, $t_{тхн}$ after power failure is 16 hours, and when power failure is caused by other carriers -- 24 hours

regardless of $t_э$. When the parameters of the process are brought to the nominal values, each plant begins operating at full productivity.

During the period of the failure of power supply of any of the power carriers ($t_{эн}$), other power agents are used for maintaining the operating state of the equipment and prevention of emergency situations. In the production of two-ethyl hexanol, some decrease in their consumption is observed, while in the production of phthalic anhydride it remains at a nominal level. During the adjustment of the technological process, the consumption of power carriers at both plants increases by 20-50%.

The main components of the damage caused by power supply failures at the above plants are the damage from unproductive consumption of power carriers $Y_{эн}$ and damage from underproduction $Y_{нп}$. Their values, as well as the value of the total damage Y, were determined on the basis of an economic-mathematical model of the interruption of the production process during power supply failures developed in [1] with consideration for concrete scheme of energotechnological interrelations (Figure 1) and data obtained as a result of a detailed study.

For initial information, we used information on annual expenditures on the production of the products according to calculations of their cost, planning and accounting documentation on the distribution of energy resources among individual plants, information about the fixed capital and working funds. For the determination of the maximum time of power supply failures which did not affect the technological process t_o, the time of the adjustment of the technological process after the restoring of electric power supply $t_{тхн}$, relative changes in the consumption of the power carriers in transient modes, and the probability of the damages to the technological equipment, the method of evaluations by experts was used [2].

Since the normative documents for the limitations of loads of industrial enterprises provide for interruptions in electric power supply of one hour, all calculations were done for the conditions of interruptions in the delivery of power carriers for that time. For a control estimation of the changes in the damage when $t_э$ increases and to obtain data for calculating the reliability indexes of the electric power supply scheme, calculations for $t_э$ = 2 hrs were conducted. The table shows the results of the calculation of damages by the technological sections and the plant as a whole when power supply is interrupted by various types of power carriers. It was established that at the two-ethyl hexanol plant, regardless of the type of power failure, 75% of the damage is from underproduction. The greatest damage among the energy components occurs when there are interruptions in the supply of circulating water and the smallest damage occurs when the supply of the cooling agent is interrupted. The highest nonproductive expenditures are connected with a considerable consumption of steam and nitrogen in transient modes. An increase in the length of $t_э$ to two hours does not cause any significant changes in the value of damage. In the production of phthalic anhydride, the main component is also the damage from underproduction (85%). Regardless of the type of power failure, the value of the damage changes insignificantly. An increase in $t_э$ leads to an increase in the damage, on the average, by 30%.

Conclusions

1. When solving the problems of evaluating damages caused by electric power supply failures, it is necessary to analyze the energotechnological connections which include plant-wide power units.

Table

Damage from the Failure of Electric Power Supply to Plants of Two-Ethyl Hexanol (DEG) and Phthalic Anhydride (FA)

(1) Наименование объекта	(2) Нагрузка, отключенная при нарушении электроснабжения, кВт	(3) Энергоноситель, нарушение снабжения которым имеет место	(4) t_0 мин (7) ДЭГ	(8) ФА	$t_э$, ч	(5) У, тыс. руб (7) ДЭГ	(8) ФА	(6) $У_э$ тыс. руб
(9) Производство ДЭГ	1100	(16) Электроэнергия	0	—	1	30,1	—	30,1
					2	31,6	—	31,6
(10) Производство ФА	3650	(16) Электроэнергия	—	0	1	—	23,6	23,6
					2	—	30,1	30,1
Блок оборотного водоснабжения (11)	1190	(17) Вода оборотная	3	0	1	44,8	23,7	68,5
					2	46,2	30,0	76,2
Водоподготовка (12)	1245	Вода свежефильтрованная (18)	3	60	1	44,7	—	44,7
					2	45,8	29,5	75,2
(13) Воздушная компрессорная	800	(19) Воздух КИП	15	0	1	44,4	23,6	68,0
					2	45,7	29,5	75,2
(14) Азотно-кислородная станция	2940	Азот газообразный (20)	0	30	1	45,5	23,1	68,6
					2	46,0	29,4	75,4
Холодильная станция (15)	2630	Хладоагент (21)	45	—	1	24,5	—	24,5
					2	27,8	—	27,8

Key:
1. Name of object
2. Disconnected load when electric power supply is cut off, kW
3. Power carrier which caused power failure
4. t_o, min
5. Y, 1000 rubles
6. $Y_э$, 1000 rubles
7. DEG
8. FA
9. DEG production
10. FA production
11. Circulating water supply unit
12. Water treatment
13. Air compressor room
14. Nitrogen-oxygen station
15. Cooling station
16. Electric power
17. Circulating water
18. Freshly filtered water
19. KIP air
20. Gaseous nitrogen
21. Cooling agent

2. The selection of rational operation modes of an enterprise under the conditions of failures of normal electric power supply must be done on the basis of an overall evaluation of the aftereffects of the changes in the technological process.

Bibliography

1. Chervonnyy, Ye. M.; Al'tman, I. V.; and Papkov, B. V. "Effect of Sudden Interruptions of Power Supply to NPZ [Oil Processing Plant] Units on the Operation of the Technological System", PROMYSHLENNAYA ENERGETIKA [Industrial Power Engineering], 1973, No 1, pp 36-38.

2. Papkov, B. V. and Khristov, I. V. "Utilization of Expert Methods in the Estimation of the Aftereffects of Electric Power Supply Failures." Abstracts of Reports for the All-Union Scientific and Technical Seminar "Young Scientists and Engineers in the Struggle for Scientific and Technical Progress in Power and Electrical Engineering", Leningrad, 1978, pp 73-77.

10,233
CSO: 1860/160

UDC 658.26.001.57:519.251

REGRESSIVE ANALYSIS OF DAMAGE FROM POWER FAILURE AT OIL PROCESSING PLANTS

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian
No 9, Sep 82 (manuscript received 16 Feb 82) pp 1049-1053

[Article by Ye. M. Chervonnyy and T. M. Shchegol'kova]

[Text] The authors examined the problems of constructing analytical models for estimating damage as a function of factors determining its value by the methods of regressive analysis on the basis of the results of computer simulation of the aftereffects of failures of power supply to the equipment of oil processing plants.

The volume of statistical information about damages caused by power failures in various sectors of industry does not make it possible to estimate even their mean value. This predetermined the trend of studies by mathematical models predicting the possible value of damage.

In this work, the construction of the damage function is based on the principle of systemic approach. The following stages are realized.

1. Breaking down the production process into elementary sections (installations) [1, 2].

2. Construction of economic-mathematical models for estimating damages by sections with consideration for the effect of power failures on the technological process of production [3].

3. Imitative computer simulation of the aftereffects of power failures at production sections according to a specially compiled program [4].

4. Construction of multifactor models of damage estimation by the results of the third stage using the method of regressive analysis.

A program was made for five oil processing plants (NPZ) which differed in their productivity, composition and structure of connections of their technological units, production technology, and geographic location.

The first three stages were examined in detail in the above-mentioned publications. This work emphasizes the fourth stage. In order to construct analytical models of

damage estimation by the results of imitative simulation, we, first of all, set the task of finding the minimum set of variables having a determining effect on the value of damage. The results of studies of various plants indicate that the consumer's damage is determined by the structure of the technological equipment whose power supply failure interrupted the production process. By examining just the power supply circuit, it is possible to characterize this structure only by the power consumption which defines ambiguously the equipment which stopped operating.

It becomes necessary to analyze the connection between the lost power and the composition of the disconnected equipment [1] as well as to introduce indexes characterizing this connection into the analytical model of damage estimation. Moreover, the enterprise at which damage is being predicted could have characteristics different from the objects by whose data the imitative models determined the damage. This also makes it necessary to broaden the range of factors to be considered.

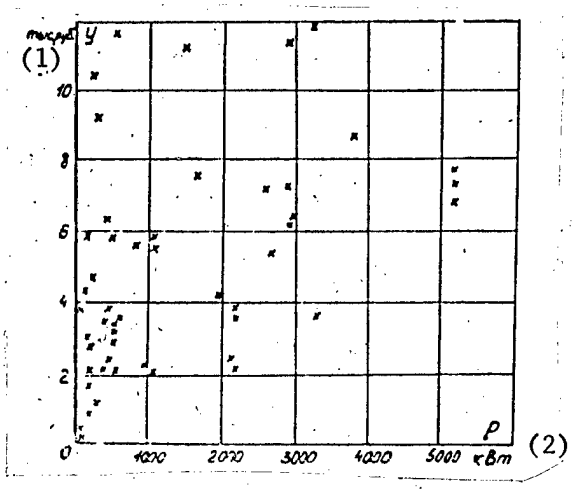

Figure 1. Damage from power failure for technological installations with different power comsumption.
Key: 1. Thousand rubles
2. kW

Figure 1 which shows the values of damage Y obtained at technological installations of one of the NPZ with different levels of electric power consumption P indicates that there is no functional dependence between Y and P. Correlation analysis shows that cut-off power determines the damage only by 10-20%.

Imitational models were used to analyze damage for the entire plant Y_{Σ} as a sum of damage occurring on the cut-off unit $Y_{cut\text{-}off}$ and on technologically connected units Y_{con}. Since the range of factors affecting the estimation of damage on cut-off and connected units is not identical and the possibility of controlling the components of damage is not identical, factors for them were analyzed separately.

On the basis of the analysis of the results of the first three stages, the following factors were examined for studying the effects of the value of damage and the expediency of their inclusion in the regressive models. For the cut-off unit:

length of interruption of power supply $t_э$, hours; unit productivity П, t; power input P, kW; expenditures on all types of energy consumed by the unit per production unit $З_{эн}$, ruble/ton; cost of fixed and working capital and conditionally constant part of expenses per one ton of production К, И, ruble/t; the portion of commodity production in the total volume of the output of the unit $П_т / П_Σ$.

In the model of damage for connected units, П, P, $П_т / П_Σ$ of the cut-off unit were considered. Moreover, the value of this component of damage is influenced substantially by the scheme of structural connection of production and the location of bunkers at the connections between the units. It is impossible to take into consideration all of the peculiarities of the process flow diagram. Only part of them are represented by quantitative factors, participation share coefficient of the cut-off unit which is estimated by the relation $ρ = П / \sum П_i$, where $\sum П_i$ is the total productivity of units of the same type together with the cut-off unit; the number of connected units including those located one, two, etc units away from the cut-off unit, n'; the number of adjacent units directly connected with the cut-off unit, n; the number of connections with adjacent units which are taken into consideration with coefficients $K_б$ characterizing the presence of bunkers at the connections, $\sum_{i=1}^{n} K_{б_i}$; the number of connections with consideration of the nature of adjacent units defined by coefficient K_s, $\sum_{i=1}^{n} K_{s_i}$.

The total damage $Y_Σ$ was estimated as a function of all above-mentioned factors. The linear form of the dependence of damage on the factors determining its value was taken in order to obtain the simplest models convenient for practical use.

Substituting the values of factors for the given unit obtained in the fourth stage of the model, we obtain a predicting evaluation of damage as a function of the length of interruption in electric power supply

$$У = b_0 + b \cdot t_э.$$

In order to correct the coefficient b in the initial model, we took into consideration not only the above-mentioned factors, but also their interaction with $t_э$: $П \cdot t_э$, $P \cdot t_э$ etc.

It is impossible to establish with the aid of the above or any other quantitative indexes the composition of the technological equipment for which damage is estimated as a result of the discontinuance of power supply to its electroreceivers. Only one method can be used here: to make up separate regression equations for technological units of various purposes. In order to estimate the degree of the effect of the composition of the cut-off equipment on the amount of damage, damage evaluation models were constructed for the total installation by the aggregate of the data obtained in initative simulation on all units being examined and separately by the types of units. In order to estimate the effects of individual peculiarities of each of the examined NPZ, generalized models were constructed both by the aggregate results of all five enterprises, and separately for each plant.

The models were constructed with the use of the computer program DOS YeS of step-by-step multiple regression STPRG. This program performs correlation and covariance analysis of the model parameters; factors are introduced alternately in the order

of the significance of their effect on the amount of damage; at each step, the input of the factor into the refinement of the model is checked and conclusions are made regarding the expediency of its inclusion into the equation; the least square method is used to calculate the regression coefficients and theoretical values of the statistical criteria of the significance and adequacy of the model.

The accuracy of the models was evaluated by a relative index: per cent variation coefficient

$$\delta = \frac{\sigma}{\bar{y}} \cdot 100,$$

where δ -- standard error of damage evaluation; $\bar{y} = \frac{\Sigma y_i}{n}$ -- mean value of damage in a sample of n values.

Statistical analysis of the results of imitative simulation and construction of analytical equations showed the following.

1. All factors selected for constructing models of the evaluation of damage on a cut-off unit are closely connected with the damage (correlation coefficient is equal to 0.2-0.8). Moreover, individual factors are substantially intercorrelated.

2. Factors selected for evaluating damage on the units of the technological line connected with the cut-off unit have a considerably lesser effect on the damage (correlation coefficient does not exceed 0.2 for most of the factors). This indicates the presence of substantial influenceswhich cannot be taken into consideration in the model.

3. The evaluation models of damage on the units connected with the cut-off unit ensure a much lower accuracy of prediction in comparison with the models for the cut-off unit (mean error of evaluation by them is 2-3 times higher).

4. Parameters of the models constructed by the methods of multiple regression for generalized installations of each of the examined NPZ have substantial differences, which indicates a considerable nonuniformity of the studied objects.

5. The least accurate models were obtained by a set of information combining all units of the five plants: relative error for the model $Y_{cut\text{-}off}$ reaches 130%; 300% -- for $Y_{connected}$ and 150% -- for Y_{Σ}.

6. Models for generalized units of concrete NPZ evaluate the damage with a higher degree of accuracy: relative error for them drops to 50, 200 and 100%, respectively.

7. Separation of the initial information into samples by the types of units made it possible to obtain an evaluation of damage with a still lower error equal, on the average, to 30% for $Y_{cut\text{-}off}$, 100% -- for Y_{con} and 70% -- for Y_{Σ}.

8. On some units, the error in the damage evaluation by regression equations for a given type of units was rather high, which indicates the necessity of excluding observations which differ sharply, separation of the sample into more uniform sets of qualitative characteristics not taken into consideration by the model, or increasing the size of the sample.

9. Consideration of factors correcting the parameters of the predicting model

$$y = b_0 + b \cdot t_э$$

in accordance with the individual peculiarities of the object for which the prediction is made ensures a substantial refinement of the evaluations (Figure 2).

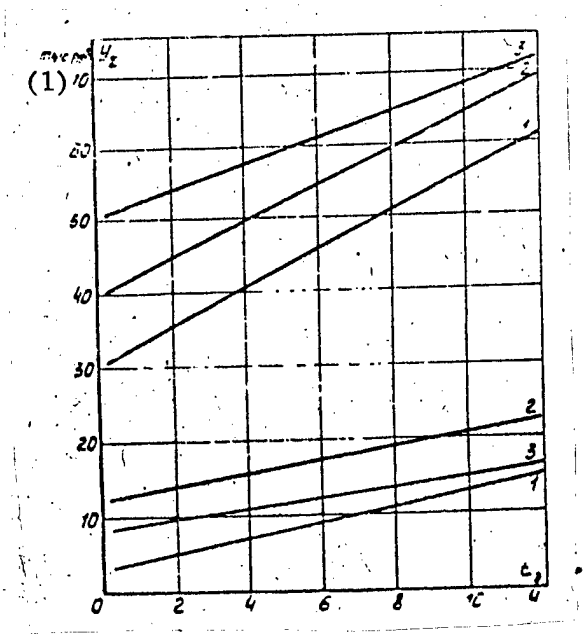

Figure 2. Predicting model $Y_{\Sigma} = b_0 + b \cdot t_э$ for AVT-type units (identical numbers designate regression lines pertaining to one NPZ).
Key: 1. 1000 rubles

10. The total number of factors included in the model which ensure the maximum obtainable refinement of the evaluation of damage does not exceed one half of the factors selected for analysis, i.e., eight-nine. However, the set of factors for evaluating damage on various technological units and at different plants is not identical. The characteristic dependence of the mean error in the evaluation of damage on the number of factors taken into consideration in the model is shown in Figure 3.

11. It was found impossible to rank the factors by the degree of their influence on the damage because of their high degree of correlational connectedness and individual peculiarities of the objects for which predictions were made.

12. The mean relative error in the evaluation of damage should be considered as the main criterion for selecting an informative set of factors and evaluation of the accuracy of analytical models, because the verification by the statistical criteria indicated the significance of all compared models having a substantially different degree of accuracy.

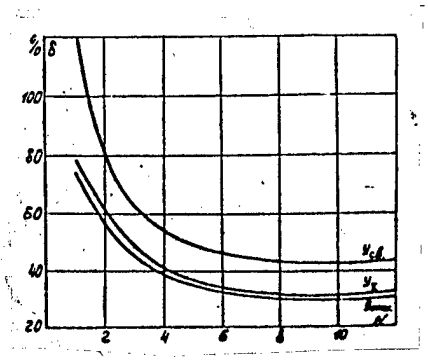

Figure 3. Dependence of the relative error of the evaluation of the damage components on the number of factor taken into consideration in the model.

Conclusions

1. Construction of analytical models of damage prediction should be done with the use of the methods of regressive analysis. This will make it possible to increase the accuracy of prediction to the highest degree and to avoid the shifting of evaluations.

2. Prediction of damage by analytical models is possible with a loss of accuracy in comparison with imitative simulation.

3. In the presence of information about the factors refining the evaluation of damage, it is necessary to use models which presuppose a high degree of knowledge of the plant by the investigator who evaluates the aftereffects of power failure at the plant.

Bibliography

1. Chervonnyy, Ye. M. "Effects of Consumer Characteristics on the Construction and Selection of the Modes of Electric Networks of Plants", ELEKTROMEKHANIKA [Electrical Engineering], 1981, No 2, pp 155-158.

2. Chervonnyy, Ye. M., and Shchegol'nikova, T. M. "Method of Constructing a Multifactor Model for Evaluating Damage Caused by Power Supply Failure at an Industrial Enterprise", in the book "Metodicheskiye vaprosy issledovaniya nadezhnosti bol'shikh sistem energetiki" [Methodological Problems of Studying the Reliability of Large Power Systems], No 18, Irkutsk, 1980, pp 95-107.

3. Chervonnyy, Ye. M.; Al'tman, I. V.; and Papkov, B. V. "Effects of Sudden Interruptions of Power Supply to NPZ Units on the Operation of the Technological Line", PROMYSHLENNAYA ENERGETIKA [Industrial Power Engineering], 1973, No 1, pp 36-38.

4. Chervonnyy, Ye. M., and Shchegol'kova, T. M. "Imitative Computer Simulation of the Aftereffects of NPP Power Failure", in the book "Nadezhnost' i ekonomichnost' elektrosnabzheniya neftekhimicheskikh zavodov" [Reliability and Economy of Power Supply at Petrochemical Plants], Omsk, 1980, pp 22-30.

5. Dreyper, N., and Smit, G. "Prikladnoy regressionnyy analiz" [Applied Regression Analysis], Moscow, Statistika, 1973, 345 pages.

10,233
CSO: 1860/160

UDC 621.039.514.25

TRANSIENT PROCESSES IN CYLINDRICAL ELECTROMAGNETIC SHIELDS

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 11, Nov 82 (manuscript received 25 Mar 81; after revision 14 May 82) pp 1307-1312

SHCHUKIN, ANDREY VLADIMIROVICH, junior research worker, Leningrad Electrical Engineering Insitute

[Abstract] The task of determining the frequency and transient characteristics of a cylindrical electromagnetic shield is studied in its two dimensional statement. It is assumed that the exciting magnetic field is quasi-steady and created by an infinitely thin cylindrical current layer with linear surface current density; the shield and surrounding medium are linear, homogeneous and have identical magnetic permeability. The production of precise frequency and transient characteristics is not difficult under these conditions. Solution of the boundary value problem for a single layer shield of finite thickness under steady conditions produces expressions for the shielding coefficient and inverse action coefficient. The approximate expressions produced can determine the frequency and the transient characteristics of cylindrical electromagnetic shields for the most characteristic cases with accuracy sufficient for practical calculations, assuming high frequency of change of the perturbing field and short transient processes or low frequency of change of the perturbing field and long transient processes. The equations are approximately as complex as known approximate formulas, but more accurate.
Figures 3; references: 7 Russian.
[124-6508]

UDC 535.345+535.411

INTERFERENCE FILTERS FOR PROTECTION FROM PARASITIC SCATTERED LASER RADIATION

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 11, Nov 82 (manuscript received 4 Dec 81) pp 36-39

MALYSHEV, G. M., MILOVANOV, N. P., PARCHEVSKIY, S. G., PUTILIN, E. S. and EL'SNER, Z. N.

[Abstract] An examination is made of the possibilities of narrow-band reflective interference filters for protection from scattered laser radiation. It is shown that effective filters for this purpose can be made by using alternating layers of dielectrics that have optical thicknesses that are multiples of $1/2\lambda_0$, where λ_0 is the wavelength at which reflection is maximum. A reflective interference filter is made for the visible region of the spectrum with $\delta\lambda/\lambda_f = 0.006$-$0.008$, where $\delta\lambda$ is the spectral interval near λ_f in which the passband changes by a factor of 10. The filter has 21 layers produced by sputtering the dielectrics in vacuum. Figures 2; tables 3; references 16: 9 Russian, 7 Western.
[176-6610]

UDC 535.863:666,189.2

INVESTIGATION OF SPECTRAL METHOD OF ELIMINATING BLOCK STRUCTURE IN IMAGE TRANSMITTED BY FIBER OPTICS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 12, Dec 82 (manuscript received 18 May 81) pp 17-19

MIKHEYEV, P. A. and PUYSHA, A. E.

[Abstract] Specialists in the development of telescopic systems have recently become interested in fiber-optics systems with spectral components that eliminate the block structure of the image and improve the resolution of fiber light guides. The dispersing elements in such systems may be either spectral prisms or flat diffraction gratings. The authors determine the necessary number of illuminated fibers for maximizing improvement of image quality in the spectral method with consideration of the comfort of observation. A set of special prisms with diffraction gratings was used to decompose the image into a spectrum and to reconstruct it. The number of illuminated unit fibers was varied by a set of lenses with different focal lengths,

and by a set of strands with unit fibers of different diameters. The number of illuminated unit fibers could be varied from 10 to 120. Resolution was measured by using oculars with different magnification to examine the image. It was found that when using the spectral method to eliminate block structure, irregularity in the configuration of unit fibers can be seen as a low-intensity chromatic background in the vicinity of the main image. When determining the resolution of such systems, the chromatic background is detrimental to the quality of the resultant image, although to a minor extent as compared with conventional fiber optics. Figures 4, references 7: 6 Russian, 1 Western.
[177-6610]

UDC 621.373.536

THERMAL DEFORMATION OF LASER ACTIVE ELEMENT WITH FREE HEAT EXCHANGE IN CAVITY OF TWO-LAMP ILLUMINATOR SYSTEM

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 11, Nov 82 (manuscript received 29 May 81) pp 15-17

BALASHOV, I. F., BEREZIN, B. G. and KHANKOV, S. I.

[Abstract] Free heat exchange in the cavity of the illuminator system for a solid-state laser is typified by inhomogeneous heat exchange conditions on the surface of the active element. In the case of a one-lamp illuminator system with the pumping lamp and active element parallel to each other in a tubular reflector, the inhomogeneity of heat exchange sets up a monotonic temperature gradient in the cross section of the active element along a line between the lamp axis and the axis of the active element. The resultant thermal deformation is equivalent to introducing an optical wedge or bending the active element. Such deformation can be eliminated by placing the active element on the axis of the illuminator cavity between two lamps equidistant from the optical element. However, this produces a more complicated type of thermal deformation, which is analyzed in this paper. In view of the serious difficulties that arise in analysis of unsteady heat exchange in a system made up of more than three elements, the analysis is restricted to the steady-state temperature field of the active element as a superposition of fields produced by each of the lamps, internal heat release in the active element, and the temperature background of the heated reflector. An expression is derived for the temperature distribution in the cross section of the active element averaged along the axis. The results show saddle-shaped deformation in which the temperature gradients in the horizontal and vertical planes are opposite in sign. Deformation can be compensated by using a prism as the opaque reflector in the optical cavity of the laser, the edge of the prism being at an angle of 45° to the plane that contains the axes of the active element and pumping lamps. Figures 2; references: 8 Russian.
[176-6610]

UDC 681.7.068.4.001.5

INVESTIGATION OF THERMO-OPTIC PROPERTIES OF MULTIMODE LIGHT GUIDES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 2, Feb 83
(manuscript received 18 Sep 81) pp 351-356

KLEVITSKIY, B. G. and KORSHUNOV, I. P.

[Abstract] When fiber-optics channels are used for remote phasing, accuracy is dependent on the sensitivity to temperature changes, especially in the microwave region where temperature changes of electric length may become comparable with the wavelength of the reference signal. In this paper, the authors consider problems relating to the thermo-optical constant of the light guide material, sensitivity of electric length of a multimode light guide to thermal changes, and feasibility of transmitting microwave reference signals over multimode light guides on an optical carrier. It is experimentally shown that a microwave subcarrier on a frequency of 7 GHz can be transmitted through a multimode light guide with excitation by He-Ne laser, with losses of the order of 3 dB per 100 m. The experimentally determined thermo-optical constant of a gradient-index light guide was $V' = 2.13 \cdot 10^{-5}$ deg^{-1}, which coincides with that of pure quartz. Fluctuations in the coefficient of transmission of the light guide on the subcarrier with temperature variation of its electric length do not exceed $\pm 10\%$ for a line length of 85 m. Fluctuations in the generalized phase of modes for a light guide of the same length are less than 20°. The authors thank R. F. Matveyev for helpful discussion of the results of the work, as well as P. P. Shevchenko and A. A. Gordeyev for much assistance in conducting the experiments. Figures 2; references 9: 7 Russian, 2 Western.
[179-6610]

UDC 681.7.068.4:531.5

FIBER GYROMETER IN GRAVITATIONAL FIELD

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 1, Jan 83
(manuscript received 14 Mar 80, after revision 8 Jul 81) pp 164-167

FATEYEV, V. F.

[Abstract] A ring gyrometer made of optical fiber for laser interferometry is considered in which opposing light beams propagate through the same waveguide of a given length L. The contour area S of the gyrometer and the number of waveguide turns m are also given. The gyrometer is mounted on a platform in a static central gravitational field, rotating about a center beyond the range of the interferometer with the vector of angular velocity freely oriented in space. The performance of this instrument is analyzed on the basis of the corresponding metric tensor in a noninertial reference system, taking into account refraction in a dispersive light guide. The interferometer is assumed to be rigid so that the distance between two adjacent points

remains constant during variation of the gravitational potential. The dependence of the phase difference between opposing light beams on the gravitational field is evaluated for a gyrometer whose contour surface remains parallel to the line from a given point to the center of the gravitating mass, with the radiation source not in the plane of that contour. A general expression is obtained for the phase difference which reveals a strong dependence on thermal and mechanical effects. The gyrometer inaccuracy caused by nonreciprocity of the light guide because of thermal and mechanical action on the fiber, as well as by its dispersional nonreciprocity, can be eliminated by scanning the plane of the gyrometer in space at an angular velocity sufficiently high to make the phase difference constant during a scanning period, then filtering out the alternating component and measuring its amplitude. References 12: 5 Russian, 7 Western (1 in translation). [151-2415]

UDC 621.315.592

INTERACTION OF GALLIUM WITH INTRINSIC DEFECTS IN GERMANIUM UNDER GAMMA IRRADIATION

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 17, No 1, Jan 83 (manuscript received 15 Mar 82, accepted for publication 25 Jun 82) pp 35-39

VASIL'YEVA, Ye. D., YEMTSEV, V. V. and MASHOVETS, T. V., Physicotechnical Institute imeni A. F. Ioffe, USSR Academy of Sciences, Leningrad

[Abstract] An investigation is made of the role played by group III acceptor dopants (exemplified by gallium) in the process of defect formation in germanium with gamma irradiation at 78 and 300 K. The specimens were p-Ge doped with Ga in a concentration of ~$2 \cdot 10^{15}$ cm^{-3}. The degree of compensation of gallium acceptor levels by antimony in the initial material was 2-3%. The gamma source was ^{60}Co. Isochronous annealing was done in the temperature range of 100-320 K with a step of 20 K, the duration of annealing at each stage being 20 minutes. Dose rates were $4.8 \cdot 10^{12}$ cm^{-2} s^{-1} for exposure at 78 K, and $1 \cdot 10^{12}$ cm^{-2} s^{-1} for irradiation at 300 K. Low-temperature irradiation, annealing and measurements were done in darkness. Temperature dependences of hole concentration and mobility were measured in a range of 4.2-300 K. The concentrations of electrically active gallium atoms and compensating donors were determined by comparing the experimental temperature dependence of hole concentration with calculations by the equation of electroneutrality. The role of radiation defects in scattering was determined by comparing the experimental temperature dependence of hole mobility with calculations by a method considering three basic scattering mechanisms: by ionized and neutral hydrogen-like centers, and by lattice vibrations. The results show that under appropriate conditions, gallium dopant in germanium effectively interacts both with intrinsic interstitial atoms and with vacancies beginning at a temperature of about 100 K. The authors thank Yu. N. Dalud for assistance during measurements. Figures 3, references 27: 14 Russian, 13 Western (2 in translation).
[175-6610]

UDC 621.315.592

EFFECT OF IRRADIATION CONDITIONS ON INTERACTION OF GOLD DOPANT WITH INTRINSIC DEFECTS IN GERMANIUM

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 17, No 1, Jan 83 (manuscript received 23 Feb 82, accepted for publication 13 Jul 82) pp 52-56

VASIL'YEVA, Ye. D., YEMTSEV, V. V. and MASHOVETS, T. V., Physicotechnical Institute imeni A. F. Ioffe, USSR Academy of Sciences, Leningrad

[Abstract] An investigation is made of the effect that the kind of irradiation and temperature have on defect formation in gold-doped p-Ge. Gold concentration in the specimens was about $1 \cdot 10^{15}$ cm^{-3}. The material also contained antimony (about $2 \cdot 10^{14}$ cm^{-3}) and gallium (about $1 \cdot 10^{14}$ cm^{-3}). Dislocation density in the investigated specimens was about 10^3 cm^{-3}. Irradiation was by reactor neutrons at 300 K or by ^{60}Co gamma rays at 78 K with dose rate of $1 \cdot 10^{12}$ $cm^{-2}s^{-1}$. Isochronous annealing was done in a range of 100-320 K with step of 20 K, the duration at each stage being 20 minutes. Irradiation, annealing and measurements were done in darkness. Temperature dependences of concentration and mobility of charge carriers were measured in a range of 4.2-300 K. Experimental temperature dependences of carrier concentration were compared with calculations derived by the equation of electroneutrality. Parameters of levels produced by radiation were determined from conditions of best coincidence of calculations with experiment. It was found that the conditions of irradiation have a considerable effect on interaction of primary intrinsic defects with electrically active gold atoms. Despite this, processes of radiation defect formation in gold-doped germanium can be described from a unified viewpoint. The authors are grateful to N. A. Vitovskiy and F. A. Zantov for participation in the discussion of the manuscript of their work, and Yu. N. Dalud and O. V. Gorshkov for assistance in conducting the experiments. Figures 3; references 17: 15 Russian, 2 Western (1 in translation).
[175-6610]

UDC 621.315.592

INFLUENCE OF ELECTRIC FIELD ON CYCLOTRON RESONANCE LINE SHAPE IN n-GaAs

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 17, No 1, Jan 83 (manuscript received 15 Jul 82, accepted for publication 28 Jul 82) pp 155-157

ALEKPEROV, O. Z. GOLUBEV, V. G. and IVANOV-OMSKIY, V. I., Physicotechnical Institute imeni A. F. Ioffe, USSR Academy of Sciences, Leningrad

[Abstract] Displacement and narrowing of the cyclotron resonance line in photoconductivity spectra of GaAs are observed when an excess concentration of free electrons is produced in the specimen with breakdown of impurities by an

electric field. It is shown that the physical mechanism responsible for both these effects is shielding electric fields of charged impurities in semiconductors. Cyclotron resonance was studied on a laser magnetic spectrometer using cw submillimeter gas-discharge vapor lasers on H_2O, D_2O and HCN. Static conductivity was measured at 4.2 K on a fixed wavelength under the action of radiation as a function of magnetic field. The specimens were epitaxial layers of n-GaAs[$N_D=(4-15)\cdot10^{14}cm^{-3}$, $K=N_A=N_D=0.36-0.65$ and $\mu_{77}=(5.7-10)\cdot10^4cm^2/V\cdot s$]. The results show that in electric fields corresponding to breakdown of impurities, the excess free electrons effectively shield the potential of the charged impurities. Figures 1; references 4: 1 Russian, 3 Western.
[175-6610]

UDC 621.315.592

CHANGE IN RECOMBINATION PROPERTIES OF DEEP LUMINESCENCE CENTERS WITH ANNEALING OF IRRADIATED GaAs CRYSTALS

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 17, No 1, Jan 83
(manuscript received 11 May 82, accepted for publication 31 Aug 82)
pp 164-166

GLINCHUK, K. D., ZAYATS, N. S. and PROKHOROVICH, A. V., Physicotechnical Institute imeni A. F. Ioffe, USSR Academy of Sciences, Leningrad

[Abstract] Previous research has shown that irradiation of GaAs crystals with gamma quanta and electrons changes the recombination properties (energy position ε_r of levels created near the valence band, coefficients of hole capture c_{pr} and electron capture c_{nr}) of deep luminescence centers. It is shown in this paper that subsequent annealing of irradiated GaAs crystals produces further heat-stimulated changes in ε_r, c_{pr} and c_{nr}, and a model is proposed to explain the observed changes. The experiments were done on Te-doped n-GaAs exposed to ^{60}Co gamma quanta at 20°C or fast neutrons. Isochronous annealing was done for 15 minutes at 100-400°C. The recombination characteristics of the 0.98 and 1.18 eV radiating centers were determined by analyzing the kinetics of quenching of "impurity" luminescence. It is found that the predominant mechanism responsible for the observed changes is increased mobility of arsenic and gallium vacancies induced by radiation. Figure 1, references: 4 Russian.
[175-6610]

UDC 681.3.04/05

PARALLEL OPTICAL PROCESSOR FOR GEOMETRICAL TRANSFORMATION OF IMAGES

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 26, No 1, Jan 83 (manuscript received 28 Jan 82) pp 75-77

OCHINA, L. B., Leningrad Institute of Water Transportation

[Abstract] Optical processing of images is considered which yields image indicators invariant with respect to the scale as well as to translation and rotation of the incoming image. Four operations are involved here: 1) Fourier transformation of the original image signal from $F(x,y)$ to $F(\omega_x,\omega_y)$; 2) Conversion of the transform from one in Cartesian coordinates $F(\omega_x,\omega_y)$ to one in polar coordinates $F(r,\varphi)$; 3) Conversion of the r-scale to a logarithmic one and thus of the transform $F(r,\varphi)$ to the transform $F(e^{\rho},\varphi)$ and 4) Conversion of the transform $F(e^{\rho},\varphi)$ to an invariant $M(\omega_\rho,\omega_\varphi)$ one. Changes due to translation and rotation are eliminated in operations 1) and 2), 4), respectively. Generally operations 1) and 4) are performed by means of a coherent optical analog processor, and operations 2) and 3) are performed by means of operational amplifiers and masks. Parallel realization of the complete transformation is shown here to be feasible with the use of an optoelectronic processor based on a page-oriented holographic read-only memory, where both input image and output image are presented as arrays of points and all points of one are related to all points of the other through a correspondence matrix in either analytical or tabular form. The capability of such a processor is limited by the capacity of available read-only memories storing 10^4-10^5 bits/page, so that the dimensions of an input image may not exceed 256x256 points. An algorithm of calculation of the correspondence matrix for simulation of such parallel geometrical transformations has been programmed in the PL/1 language for Unified System computers. The paper was recommended by the Department (Kafedra) of Automatics, Leningrad Institute of Water Transportation. Figures 3; references: 2 Western.
[149-2415]

MECHANISMS OF RESONANT GALVANOMAGNETIC EFFECT IN FERRITE-SEMICONDUCTOR STRUCTURE

Ashkhabad IZVESTIYA AKADEMII NAUK TURKMENSKOY SSR: SERIYA FIZIKO-TEKHNICHESKIKH, KHIMICHESKIKH I GEOLOGICHESKIKH NAUK in Russian No 4, Apr 82 (manuscript received 19 Nov 81) pp 17-22

ALIYEV, T. D., VASHKOVSKIY, A. V., ZUBKOV, V. I. and SUKHANOV, S. S., Physico-Technical Institute at TuSSR Academy of Sciences and Institute of Radio Engineering and Electronics at USSR Academy of Sciences

[Abstract] New microwave transducers for a wide range of applications can be built on the basis of the resonant galvanomagnetic effect in devices with both semiconductor and magnetic characteristics. The mechanism of this effect,

depending on device and contact geometry, can be the Hall current, focusing currents, and rectification at the contacts, any combination of these, or, least significantly, nonuniform heating of the material. An experimental study was made of ferrite-semiconductor structures consisting of thin n-InSb film strips, arcuate or rectangular, deposited on disks of iron-yttrium garnet (saturation magnetization $4\text{-}M_0$ = 1750 G, width of resonance line $2\Delta H \sim 1$ Oe). Weakly rectifying contacts were produced by fusion of alloy (98% In+ 2% Zn) tabs into the specimens. Such structures were tested and compared with similar ones having nonrectifying contacts (pure In tabs fused in). Measurements were made at microwave frequency of 3 GHz, with pulses of 50 μs duration and 30 Hz repetition rate, in a constant magnetic field perpendicular to the plane of the f-n structure. The rectification factor was measured as a function of the amplitude of an a.c. voltage signal. The constant emf was measured as a function of the magnetic field intensity, with the magnetic field oriented upward or downward, at various levels of microwave power. It was also measured as a function of the microwave power, at room temperature and at liquid-nitrogen temperature, with the magnetic field oriented upward or downward. The results indicate that such f-n structures rectify not only spin waves but also "low-frequency" oscillations of magnetization, the Hall-current mechanism being the dominant one. However, nonlinearity of contacts is also a contributing factor which aids the effect of focusing currents. Figures 3; references: 12 Russian.
[148-2415]

UDC 537.6

BARKHAUSEN NOISE DEPRESSION IN FERRITES UNDER ULTRASONIC ACTION

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 2, Feb 83
(manuscript received 16 Sep 81) pp 402-403

MIKOLAYTIS, G. S. and PALENSKIS, V. P.

[Abstract] An investigation is made of the influence that volumetric longitudinal ultrasonic waves have on the level of Barkhausen noises in polycrystal yttrium ferrite garnet (YFG). The specimens were plates of YFG type 40SCh measuring 25 x 25 x 2 mm placed in the alternating magnetic field of a solenoid. The noise signal of a flip coil placed over the specimen was amplified and sent to a spectrum analyzer with a controlled integrator. The frequency of magnetic alternation was 1 Hz, and the frequency of ultrasound was 1 MHz. The results of measurements show that ultrasound reduces Barkhausen noises, with maximum depression of more than 20 dB in the range of 1-20 kHz. The depression effect is attributed to the action of ultrasound on the crystal lattice of the ferrite caused by the mutual influence of the elastic and magnetic subsystems of the YFG. Under the action of ultrasound the domain walls oscillate, and the axis of easy magnetization of the domains precesses, leading to fractionation of Barkhausen steps. Figures 2, references: 2 Western.
[179-6610]

UDC 537.312.62

SOME PROBLEMS OF USING SUPERCONDUCTING EXCITER WINDINGS IN 'FROZEN' FLUX MODE

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA
in Russian No 11, Nov 82 pp 1344-1347

IVANOV, SERGEY NIKOLAYEVICH, graduate student, Leningrad Polytechnical Institute; and LUPKIN, IVAN DMITRIYEVICH, junior research worker, Leningrad Polytechnical Institute

[Abstract] Operation of a superconducting winding in the frozen flux mode is characterized by constant flux linkage and all external perturbations causing changes in magnetic field acting on the winding lead to fluctuations in current. In the most complex cases a change in winding position relative to field sources makes calculation of induced current difficult. The energy losses in the winding are covered almost completely by decreasing current. The operation of windings under these conditions is studied by representing a combined conductor as an equivalent wire with a cross section equal to that of the matrix and all superconducting filaments and assuming that the external magnetic field changes arbitrarily in the direction perpendicular to the conductor. Solution of the equation for the superconducting cylinder yields the specific energy losses to eddy currents in the matrix. One interesting peculiarity of superconducting windings in the frozen flux mode is that a portion of the losses is covered by the operation of the external field source. Figures 2; references 11: 5 Russian, 6 Western (1 in translation). [124-6508]

UDC 537.312.62

ENERGY PARAMETERS OF SUPERCONDUCTING TRANSFORMER TYPE CONVERTERS

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 11, Nov 82 (manuscript received 25 Mar 81; after completion 14 May 82) pp 1356-1358

IGNATOV, VLADIMIR YEVGEN'YEVICH, candidate of technical sciences, senior scientific research worker, Scientific Research Power Engineering Institute imeni G. M. Krzhizhanovskiy; KUZ'MIN, ALEKSANDR VALER'YEVICH, junior research worker, Scientific Research Power Engineering Institute imeni G. M. Krzhizhanovskiy; and SKOBARIKHIN, YURIY VITTOVICH, leader of group, Scientific Research Power Engineering Institute imeni G. M. Krzhizhanovskiy

[Abstract] One task of modern applied superconductivity science is the development and creation of devices to feed high-amperage superconducting magnets. One means of performing this task is to use superconducting transformer type converters. The operating principle and conditions of one time action superconducting transformers and valve type pumping flux supplies are described. A comparative estimate of the maximum current and power stored in a load allows determination of the area of application of devices of this type. References: 5 Russian.
[124-6508]

UDC 537.312.62

STUDY OF A NITROGEN COOLED CRYOTURBINE GENERATOR MODEL

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 11, Nov 82 (manuscript received 25 Mar 81; after completion 14 May 82) pp 1359-1362

VOLOVIK, VLADIMIR IVANOVICH, chief designer, Physicotechnical Institute of Low Temperatures, Academy of Sciences, UkSSSR; GRINBAUM, IOSIF NATANOVICH, candidate of technical sciences, senior scientific-research worker, Scientific Research Institute LPEO (expansion unknown) "Elektrosila" [Electric Power]; RYBIN, URIY LEONIDOVICH, candidate of technical sciences, senior scientific-research worker, Scientific-Research Institute LPEO "Elektrosila"; and FILIPPOV, IOSIF FILIPOVICH, candidate of technical sciences, Scientific Research Institute LPEO "Elektrosila"

[Abstract] The problem of effective functioning of cooling systems is among the most difficult related to the introduction of superconducting devices to engineering practice. Some aspects of the operation of superconducting devices can only be studied when helium is used as the coolant. However, when nitrogen cooling can be used, as in studies of the mechanical condition of bearings, seals and cooling agent input devices, it is a much more convenient fluid. A model is described with a rotor equipped with 30 resistance

thermometers, cooling fluid input through a siphon and with a seal in the central cavity of the winding. Cooling of the device is described. Graphs of the change in nitrogen flow rate and temperature are presented. Figures 4.
[124-6508]

UDC 537.312.62

CAPACITIVE ELECTRIC MOTOR FOR ROTATION OF MAGNETICALLY SUSPENDED SUPERCONDUCTING BODY

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 11, Nov 82 (manuscript received 25 Mar 81; after completion 14 May 82) pp 1363-1367

SVYATYY, VASILIY VASIL'YEVICH, engineer

[Abstract] Utilization of the superconductor body itself as an electric motor rotor provides significant advantages in studies of the properties of superconductors used in motors. The need to avoid heat flux to the superconducting specimen which is maintained in a high vacuum at liquid helium temperature makes the use of a capacitive motor with a magnetically suspended superconducting body attractive. Such a motor is diagrammed and described. The operating principle is based on the change in capacitance between stator and rotor electrodes as they move relative to each other. An experimental test of the motor under static and dynamic conditions was performed with both spherical and cylindrical rotors. The torque developed was slight with high power supply voltages. Torque can be increased by using materials with high dielectric permeability as the poles. One advantage of this motor design is that there is no interaction between the drive and the magnetic suspension fields and there are no heat losses in the rotor, which achieves high purity of physical experiments. Figures 4; references 4: 2 Russian, 2 Western.
[124-6508]

UDC 537.312.62

SELECTION OF PROTECTIVE CIRCUITS FOR ELECTRIC MACHINES WITH SUPERCONDUCTING MAGNETIC SYSTEMS

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 11, Nov 82 (manuscript received 25 Mar 81) pp 1368-1371

AKOPYAN, DORVARA GURGENOVICH, graduate student, Leningrad Electrical Engineering Institute

[Abstract] Protection criteria which must be used in order to evaluate and select protective circuits for electric motors with superconducting magnetic systems are noted: 1) Permissible rate of change of current in the motor; 2) Current at which protective system operates; 3) Time of operation of

protective systems; and 4) Sensitivity factor. Each of these characteristics is mathematically described. The protective criteria selected greatly simplify the selection of electrical systems and devices designed to protect electric motors with superconductive magnetic systems. This reduces the possibility of damage to the magnet system under transient conditions and facilitates support of the necessary reliability, speed, sensitivity, selectivity and noise tolerance. Figures 1; references 10: 2 Russian, 8 Western (1 in translation).
[124-6508]

UDC 537.312.62

CONTROL OF SUPERCONDUCTING EXCITER WINDING CURRENT

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 11, Nov 82 (manuscript received 25 Mar 81; after completion 14 May 82) pp 1374-1376

LERNER, DMITRIY MATVEYEVICH, candidate of technical sciences, senior scientific research worker, Leningrad Electrical Engineering Institute

[Abstract] In the case of a constant exciter current a superconducting winding may either be closed by a superconducting switch or connected to a low voltage controlled voltage supply. The permissible rate of change of exciter current may be one of the main factors determining the sensitivity and quality of control. A superconducting exciter winding is an integrating element in the first approximation. An increase in dynamic impedance decreases the time constant but slows the transient process and is therefore undesirable. In order to decrease the exciter current, the exciter winding must be closed through a resistance. An estimate of the parameters of exciter winding power supplies indicates an emf of 5 to 10 V and a power of 2.5 to 10 kW for a current of 0.5 to 1 kA. A thyristor automatic switching unit can be used to track the required controlled variables. References: 2 Russian.
[124-6508]

UDC 537.312.62.029.6

RESPONSE OF SELECTIVE RECEIVER WITH JOSEPHSON DETECTOR TO MICROWAVE SIGNALS WITH VARIOUS SPECTRA

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 2, Feb 83 (manuscript received 27 Jul 81) pp 371-375

KULIKOV, V. A. and POSPELOV, M. N.

[Abstract] A Josephson detector is capable of operating in a self-selection mode because of the occurrence of vertical current steps on the current-voltage characteristic of the Josephson junction at voltage values $V_n = nhf/2e$,

where n is an integer, and f is the frequency of the incident electromagnetic radiation. Thus the Josephson detector can be used as a basis for a frequency-tunable selective receiver. The input band of such a receiver is determined by the parameters of the detector, and tuning to the required frequency band is accomplished by varying the bias voltage. An analysis is made of the behavior of the receiver response upon receiving signals with various spectra, which is of interest for determining the capabilities for using such a receiver as a microwave spectrum analyzer. It is shown that the response of the receiver for any input signal lying in a limited frequency band is characterized by negative limbs. The integral distribution of the response is zero. The width of the response for spectral width $\delta<<1$ is close to the width of the spread function, and for spectral width $\delta>>1$ the response width is proportional to δ. Response amplitudes depend both on signal intensity and spectral width. The amplitude of the response decreases monotonically with increasing δ. The response is zero for a broad signal (such as noise) regardless of signal intensity. The spectrum of the input signal can be determined from the shape of the response spectrum. Figures 3; references 10: 7 Russian, 3 Western.
[179-6610]

UDC 537.533.2

FIELD-EMISSION CAPABILITY OF CATHODE FILAMENT GROWN BY ELECTRIC DISCHARGE IN $W(CO)_6$ VAPOR

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 1, Jan 83 (manuscript received 9 Apr 82) pp 197-199

OVSYANNIKOV, N. P. and SHUPPE, G. N.

[Abstract] Multipoint arrays of cathode filament crystals were produced by decomposition of $W(CO)_6$ in an electric discharge in its vapor. The diode was first evacuated to a residual pressure of $1.5 \cdot 10^{-5}$ Pa and then filled with $W(CO)_6$ vapor to a pressure of 0.25 Pa (sublimation pressure of $W(CO)_6$ at room temperature). The cathode was subsequently heated to 700-800 K, whereupon a 10 Mohm current-limiting resistor was inserted between disk anode and point cathode prior to application of 2-3 kV across the electrodes. The current-voltage characteristic was measured twice, first with the original diode at residual pressure and then again after evacuation of the diode with built-up cathode back to residual pressure levels. The stability of the cathode field-emission current was tested over a period of 100 h. With the crystal growing process (time) optimized, both the magnitude and the stability of the cathode field-emission current were found to be adequately high within the 100-200 μA range at an anode voltage of 400-600 V. Figures 5; references 3: 1 Russian, 2 Western.
[151-2415]

UDC 599.2:519.28.669

POSSIBILITY OF DESIGNING HIGH SPEED SUPERCONDUCTING AC MACHINES

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 11, Nov 82 (manuscript received 25 Mar 81) pp 1376-1378

MAVROMATI, GALINA SPIRIDONOVNA, candidate of technical sciences, senior scientific research worker, Leningrad Electrical Engineering Institute; VASIL'YEVA, IRINA VYACHESLAVOVNA, senior engineer, Leningrad Electrical Engineering Institute; and KOMAROVA, GALINA VASIL'YEVNA, junior research worker, Leningrad Electrical Engineering Institute

[Abstract] The use of superconducting materials for synchronous machine exciter windings can significantly decrease rotor diameter and mass. Equations are presented for the mass and diameters of exciter windings. The design of all the elements of the hollow rotor is based on the maximum torque, with consideration given to the plastic moment of resistance and the permissible twisting stress for the cross section. The theoretical design calculations indicate that the radial thicknesses of rotor elements necessary in order to achieve shielding satisfy the requirements of strength and vibration resistance for the rotor of a high speed turbine generator spinning at 6000 to 12,000 rpm. Figures 2; references 3: 2 Russian, 1 Western.
[124-6508]

UDC 621.3.078

STABILIZATION OF SUPERCONDUCTING STATE OF CABLE SYSTEM BY AUTOMATIC REGULATION EQUIPMENT

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 11, Nov 82 (manuscript received 25 Mar 81; after completion 14 May 82) pp 1348-1355

YAKIMETS, IGOR' VLADIMIROVICH, candidate of technical sciences, senior scientific-research worker, Scientific Research Power Engineering Institute imeni G. M. Krzhizhanovskiy; ALEKSEYEV IGOR' ALEKSANDROVICH, junior research worker, Scientific Research Power Engineering Institute imeni G. M. Krzhizhanovskiy; and BLINKOV, YEVGENIY LEONIDOVICH, candidate of technical sciences, senior scientific research worker, Scientific-Research Power Engineering Institute imeni G. M. Krzhizhanovskiy

[Abstract] The concept of stabilization is widely used in the design of superconducting magnetic systems and refers to a number of steps used to prevent the development or propagation of normal zones in the windings. In contrast to magnetic systems, power transmission lines operate with a variable load schedule and may be overloaded by emergency currents. The economic aspects of the planning of such lines limit the capabilities for designing in stabilization. From the standpoint of loss of superconductivity, the behavior

of a line in an emergency state is described by a system of differential equations, which is presented in the article. An expression is presented for calculation of heat liberation in the line, after disconnection of the short circuit sector. The prospects for future use of superconducting transmission lines must be based on the use of existing equipment and mechanisms. This article suggests development of post emergency current regulation systems on the basis of advance information concerning the post emergency states of the transmission line at the moment of a short circuit disconnect. Transient processes in a superconducting power transmission line are presented in graphic form and a diagram is presented of an automatic system for stabilization of the superconducting state of parallel lines. Figures 4; references: 3 Russian.
[124-6508]

UDC 621.039.514.25

ELECTRODYNAMIC TRANSIENT PROCESSES IN SUPERCONDUCTING MAGNETIC SYSTEMS UPON FIELD DAMPING

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 11, Nov 82 (manuscript received 25 Mar 81; after revision 14 May 82) pp 1302-1306

YANTOVSKIY, LEONID ISAAKOVICH, candidate of technical sciences, dotsent, Kharkov Polytechnical Institute; MIROSHNICHENKO, ANATOLIY GEORGIYEVICH, junior research worker, Kharkov Polytechnical Institute; and BERZIN, YEVGENIY KARLOVICH, junior research worker, Kharkov Polytechnical Institute

[Abstract] A method is presented for calculating transient processes upon damping of a magnetic field in a superconducting system with a multilayer ferromagnetic core with 2p separate poles and cryostats with superconducting exciter coils. The method outlined allows estimation of the mechanical strength of elements, selection of efficient designs and materials for the shells, determination of their operating temperature and calculation of the protective impedance. Figures 2; references: 2 Russian.
[124-6508]

UDC 621.313.2.077.3

ANALYSIS OF INFLUENCE OF DC CRYOMOTOR LOAD ON MAGNETOMOTIVE FORCE OF SUPERCONDUCTING EXCITER WINDING WITH POWER SUPPLY DISCONNECTED

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 11, Nov 82 (manuscript received 25 Mar 81; after completion 14 May 82) pp 1298-1301

MILYKH, VLADIMIR IVANOVICH, candidate of technical sciences, senior instructor, Kharkov Polytechnical Institute

[Abstract] A study is presented of the influence of a cryomotor load on the magnetomotive force in shorted superconductor exciter winding coils. The study was performed for a 10,000 kW cryomotor with armature diameter 2.5 m, active length 1.3 m, 10 poles. The basis of the study was the property of a superconducting circuit to maintain magnetic flux linkage constant. Assuming the magnetic system symmetrical, one coil of the exciter winding is studied. An equation for α as a function of β is derived corresponding to quasi-steady occurrence of electromagnetic processes in the motor, which is close to the real situation, because the frequency of reverses is about 0.2 Hz. The equation can be used for approximate estimation of the possible rate of change of coil current if we know the rate of change of load current. The need is determined for effective damping circuits to protect superconducting exciter windings from the influence of motor load current. Figures 2; references 5: 4 Russian, 1 Western.
[124-6508]

UDC 621.313.32

EQUATIONS OF SYNCHRONOUS MACHINE WITH SUPERCONDUCTING EXCITER WINDING AND DISTRIBUTED PARAMETERS

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 11, Nov 82 (manuscript received 25 Mar 81) pp 1286-1292

TALYSHINSKIY, ISRAFIL TEYMUROVICH, doctor of technical sciences, professor, Leningrad Electrical Engineering Institute

[Abstract] The primary task of this work was to compose equations for a synchronous machine with a superconducting winding considering distributed parameters obtained by a three-dimensional representation of the magnetic field in a cylindrical system of coordinates. The given quantities are voltage, winding data and machine part geometry. The essence of the method is that the electric machine is first represented as absolutely transparent with respect to the unperturbed electromagnetic field of the stator or rotor winding. The area of the undisturbed field is divided into two subareas, above and below the current layer of the winding. Solution of the Laplace equation for the common term of the harmonic series in the axial component of

the undisturbed vector magnetic potential wave is written as two terms, then the disturbing bodies in the inner and outer areas are introduced. The reflection and shielding coefficients are assumed to be known. The equations produced allow determination of the expressions for operator inductive impedances of the stator and rotor considering the distributed shield parameters. These equations are obtained for the first time in a three-dimensional representation of the magnetic field in the cylindrical system of coordinates, more adequately reflecting the physical phenomena than equations with equivalent parameters. Figures 2; references: 7 Russian. [124-6508]

UDC 621.313.001.24:512.831

METHODS OF CALCULATING ELECTROMAGNETIC FIELDS OF SUPERCONDUCTING UNIPOLAR ELECTRIC MACHINES

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 11, Nov 82 (manuscript received 25 Mar 81) pp 1269-1273

BELOPOL'SKAYA, YELENA BORISOVNA, candidate of technical sciences, junior scientific worker, Leningrad Electrical Engineering Institute; GOTOVTSEV, NIKOLAY PETROVICH, senior engineer, Leningrad Electrical Engineering Institute; and FEDOSOV, MIKHAIL IVANOVICH, candidate of technical sciences, senior scientific research worker, Leningrad Electrical Engineering Institute

[Abstract] The most effective and universal numerical methods for calculating the electromagnetic fields of unipolar superconducting electric machines are the methods of integral equations and finite differences, both of which were used to calculate the electric field of such a machine. The calculations performed showed the expediency of using both of the methods to study electromagnetic processes in superconducting unipolar electric machines. The similarity of the results obtained guarantee their reliability. These algorithms allow expensive physical modeling to be avoided in the design development stage. The methods allow automation of the process of calculating electromagnetic fields in such machines. Figures 2; references: 5 Russian. [124-6508]

UDC (621.313.322-81.044.3:537.312.62).001.5

STUDY OF THERMAL FIELD OF TURBOGENERATOR ROTOR WITH SUPERCONDUCTING EXCITER WINDING

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 11, Nov 82 (manuscript received 25 Mar 81; after completion 14 May 82) pp 1274-1280

BELYAYEV, SERGEY NIKOLAYEVICH, junior research worker, VNIIelektromash (All-Union Scientific-Research Institute of Electrical Machines); BRYNSKIY, YEVGENIY ALEKSYEVICH, scientific coworker, VNIIelektromash; DANILEVICH, YANUSH BRONISLAVOVICH, doctor of technical sciences, professor, chief of laboratory, VNIIelektromash; ZHURAVLEVA, TAT'YNA YEVGEN'YEVNA, junior research worker, VNIIelektromash; and SMOLIN, IGOR' MIKHAYLOVICH, candidate of technical sciences, scientific coworker, VNIIelektromash.

[Abstract] The thermal field of a cryoturbine generator rotor was calculated in order to determine the necessary helium flow to maintain the superconducting state of the exciter winding under nominal and long-term abnormal operating conditions and to select a rotor design guaranteeing mechanical strength. The method is based on making several simplifying assumptions: half the rotor is analyzed in the axial direction, considering that the rotor is symmetrical relative to the middle of its length; it is considered that the thermal processes in the rim and heat shield do not influence the thermal field of the electromagnetic shield or flanges; the thermal field of the rim and heat shield is assumed homogeneous in the tangential direction; the ratio of radial dimensions of the area studied to the radius of the outer surface is assumed to be about 1/10, allowing rectangular coordinates to be used; the thermal shield and bridge are divided into several sections so that quantities can be considered constant within the sections; heat exchange with gas moving through the helical channels of the thermal bridge is not considered; the thickness of the thermal bridge and rim is assumed identical. The method suggested allows calculation of the two-dimensional thermal field in the moderate and low temperature zones of the turbine generator rotor. Large temperature gradients in the steady states are concentrated near the flanges and thermal bridges. Figures 3; references: 6 Russian. [124-6508]

UDC 621.313.322:539.4

CALCULATION OF ELECTRODYNAMIC FORCES ACTING ON CYLINDRICAL CRYOTURBINE GENERATOR ROTOR ENVELOPES DURING TRANSIENT PROCESSES

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 11, Nov 82 (manuscript received 25 Mar 81) pp 1281-1285

KUYEVDA, VALERIY PETROVICH, dotsent, Kiev Technological Institute of the Food Industry

[Abstract] The system of differential equations describing transient processes in a cryoturbine generator models each metal shell of the rotor cryostat by two equivalent windings, one longitudinal, the other transverse to the exciter winding. Thick shells may be divided into several adjacent cylindrical layers for more precise consideration of the eddy current distribution. A cylindrical system of coordinates is used. It is assumed that the density of induced eddy currents is sinusoidally distributed in the aximuthal direction. Each shell of the rotor is modeled by equivalent windings so that the currents in the windings are equal to the current projections on the longitudinal and transverse axes. The variation in radial and azimuthal components of EMF as a function of time and circumference is illustrated in graphs. Figures 2; references: 1 Russian.
[124-6508]

UDC 621.314.32

CALCULATION OF CURRENTS IN CRYOTURBINE GENERATOR WINDINGS UPON SUDDEN THREE PHASE SHORT CIRCUIT ON STATOR TERMINALS

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 11, Nov 82 (manuscript received 25 Mar 81) pp 1293-1297

SIGAYEV, VLADIMIR YEVGEN'YEVICH, graduate student, VNIIelektromash

[Abstract] One of the most difficult conditions for a turbine generator is a sudden three-phase short circuit on the connection terminals of the stator. A review of the literature indicates that there are no accurate methods of calculating the short circuit currents under these conditions for synchronous machines with superconducting exciter windings. An equation is derived for the currents after several periods of the transient process in a cryoturbine generator stator. A method is given for analytic calculation of the currents in the windings of the generator with two shields on the rotor. Comparison of the calculation results with the results of a more precise solution of the full system of differential equations by digital computer shows that the assumptions made introduce little error to determination of the transient currents in the windings. The method can be used to replace solution of the full system of Park-Gorev differential equations, thus saving computer time and memory in calculating short circuit currents. Figures 2; references 10: 9 Russian, 1 Western.
[124-6508]

UDC 62-83:537.312.62

SPECIFICS OF STARTUP OF AUTOMATIC AC ELECTRIC DRIVE WITH SUPERCONDUCTING SYNCHRONOUS MACHINES

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 11, Nov 82 (manuscript received 25 Mar 81) pp 1378-1379

VOSKOBOVICH, VALERIY YULNANOVICH, candidate of technical sciences, dotsent, senior scientific-research worker, Leningrad Electrical Engineering Institute; KOLESNICHENKO, NIKOLAY ALEKSANDROVICH, candidate of technical sciences, scientific worker, Leningrad Electrical Engineering Institute; and RUKAVISHNIKOV, SERGEY BORISOVICH, candidate of technical sciences, dotsent, scientific worker, Leningrad Electrical Engineering Institute

[Abstract] One main problem in the planning of a synchronous electric drive system is to assure reliable startup of the actuating motor. This task is greatly complicated in the case of an independent electric drive in which startup of the motor is performed by a limited power generator. In order to test the amount of necessary exciter forcing, asynchronous startup of a superconducting synchronous motor by a superconducting synchronous generator with a power 30% greater than the motor power was calculated. The resistance torque on the motor shaft at the end of asynchronous startup was assumed to be 10% of the nominal motor torque. The calculations showed that with a favorable ratio of generator and motor powers and slight moment of resistance on the motor shaft the generator excitation must be forced beyond the permissible value. The startup was calculated to be satisfactory with acceptable quality of transient processes. Figure 1; references: 3 Russian. [124-6508]

CSO: 1860

- END -